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A SYSTEM OF TREATMENT

In Four Volumes

VOLUME III.

SPECIAL SUBJECTS

A SYSTEM OF TREATMENT

IN FOUR VOLUMES

Volume I. General Medicine and Surgery

Volume II. General Medicine and Surgery

Volume III. Special Subjects

Volume IV. Obstetrics and Gynæcology

A SYSTEM OF TREATMENT

BY MANY WRITERS

EDITED BY

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VOLUME III.

SPECIAL SUBJECTS

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PREFACE.

During the last ten years our knowledge of the measures available for the treatment of disease and the relief of symptoms has become more scientific and therefore more definite in its application. Not only have many of our ideas undergone profound modification, but new fields of work, some of great promise, have been discovered. Of these we may instance Vaccine Therapy, X-ray Therapy, Radium Therapy, Ionic Medication and measures dependent on improved methods of observation and diagnosis such as Bronchoscopy. The subject of the treatment of disease consequently has become more specialised and makes greater demands upon all branches of the medical profession than formerly.

The aim of these volumes is to provide the General Practitioner with a series of practical articles, in as concise a form as possible, describing the modern methods of dealing with all diseases and written by those who have had special experience in the subjects with which they deal.

There are many difficulties in preparing such a work as this. Our knowledge is not yet sufficiently exact to permit dogmatic expression in all instances, or to enable us to differentiate sharply between the various forms of disease. It is therefore inevitable that certain articles should overlap, and that there should be legitimate differences of opinion not only in the subject-matter itself but also with regard to the classification adopted. The Editors have always been guided in their final decision by considerations of convenience rather than of strict symmetry. They recognise that their decisions are therefore open to criticism and will gladly welcome suggestions, either for alterations or additions, to be incorporated in future issues.

This "System of Treatment" was commenced rather less than two years ago, and it is hoped that no material addition to our knowledge made during that period has been omitted. The attempt to keep thoroughly abreast of these additions has been rendered rather more difficult than usual by the decision to issue all four volumes simultaneously, and to provide each with an index which is complete for the whole work.

The Editors wish to express their gratitude to a large number of their colleagues who have in one way or another generously come to their assistance. Sir Patrick Manson, Sir Havelock Charles, Dr. St. Clair Thompson, Dr. Risien Russell, Dr. Gordon Holmes, Mr. Richard Lake and Mr. Victor Bonney have advised them with regard to those departments of Medicine and Surgery with which their names are associated. Dr. Nachbar has kindly given his advice and has also revised a number of the manuscripts. Dr. Torrens and Mr. Frankau, respectively Medical and Surgical Registrar at St. George's Hospital, have acted as sub-editors, reading all the manuscripts and assisting in the passage of proofs through the Press.

The Editors are also indebted to Mr. Charles Hewitt for the preparation of the complete index attached to each volume, to Mr. A. L. Clarke for the correction of the references, and to Mr. J. D. Marshall, of Messrs. Bell and Croyden, who is responsible for the correctness of the various prescriptions.

In addition to the many original illustrations a number of others have been kindly lent by different authors and publishers. These are duly acknowledged in the text.

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I

A SYSTEM OF TREATMENT.

SPECIAL FORMS OF TREATMENT.

ANÆSTHETICS.

General Anæsthetics, drugs which produce insensibility to pain together with unconsciousness, are employed (1) in connection with surgical operations; (2) for various physical examinations, and (3) for the relief of pains or spasm, as in child-birth and in certain painful or spasmodic affections, such as tetanus and asthma. The principles upon which they are administered are the same in the three classes of case. The first class, however, includes by far the largest number of cases, and no special descriptions will be given therefore of administration as applied to the other two. It may be said at once, however, that when used for relief of pain or for abolition of muscular spasm, anæsthesia is usually necessary only to a considerably less degree than that required in connection with surgical operations. We shall deal with the subject under the following headings:

(1) The general anæsthetics in common use and the methods by which they are administered; (2) the principles upon which the most suitable anæsthetic and method for various cases are decided upon; (3) administration in certain special operations; (4) difficulties and dangers that may arise in the course of anæsthesia; (5) the treatment of after-effects; and (6) intravenous, spiral, and local anæsthesia.

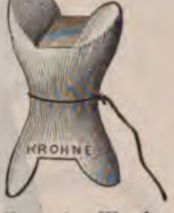

Fig. 1.—Wooden mouth-prop.

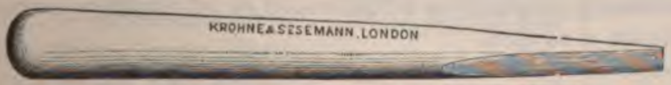

Fig. 2.—Wooden wedge for separating clenched teeth.

Certain steps are advisable before the administration of any anæsthetic whatever. Firstly, a rough estimate should be formed of the patient's general condition by inspection and by listening to the heart, feeling the pulse, estimating the respiratory capacity by placing a hand upon each side of the chest while a deep breath is drawn, and by inspecting the open mouth. The bladder should be emptied and the last meal should be at least four hours previously. There should be at hand a small prop for placing between the teeth, coupled by a few inches of silk cord to a wooden wedge which allows of these being separated if clenched (Figs. 1 and 2), a Mason's gag and a pair of tongue forceps (Figs. 3 and 4). A small honeycombed sponge for clearing the pharynx and simple tracheotomy instruments complete the essentials, although in the case of long or severe operations the anæsthetist should be provided with the proper remedies for combating shock, viz., a transfusion apparatus, a preparation of adrenalin or of pituitary extract, and a cylinder of oxygen.

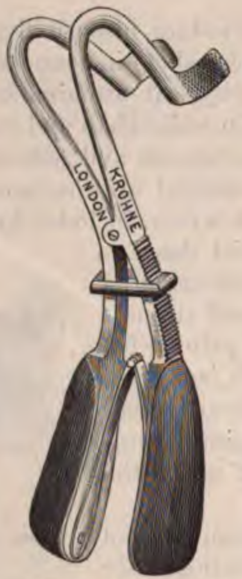

FIG. 3.—Mason's gag.

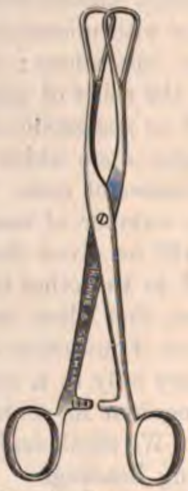

FIG. 4.—Tongue forceps, the blade having rounded edges.

THE GENERAL ANÆSTHETICS IN COMMON USE AND THE METHODS BY WHICH THEY ARE BEST ADMINISTERED.

Nitrous Oxide.—Nitrous oxide (N_2O, protoxide of nitrogen, laughing gas), being under ordinary conditions a gas, is supplied for practical purposes in its liquid form under pressure in iron or steel cylinders. Fifteen ounces of the liquid supply about 50 gallons of the gas, and the cylinders are made in sizes to supply from 25 to 100 gallons. The larger are generally used in hospital, the smaller in private practice. The gas is released from the cylinders by the action of a valve which relieves the pressure upon the liquid. The cylinders carry a label stating the weight of liquid nitrous oxide contained, and this should be verified by weighing before the use of a cylinder is begun. By using two cylinders coupled together and continuing the use of one till that is exhausted before starting upon the other, the administrator avoids the risk of being suddenly left with empty cylinders, the empty one being replaced by a full one as soon as it is found to be empty. The most convenient stand and the best valves are provided in the arrangement (Fig. 5) devised by Messrs. Barth & Co., London. The figure shows also Hewitt's two-way stopcock and face-piece, which is the most suitable apparatus by which to give the gas.

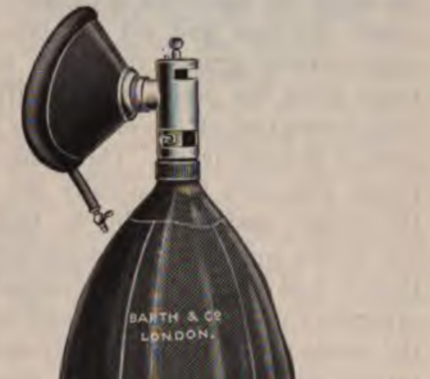

FIG. 5.—Apparatus for administration of nitrous oxide gas.

Nitrous oxide may be given alone or in conjunction with air or with oxygen. If given alone, only a short anæsthesia, lasting about forty seconds, is obtainable, the administration being terminated by the commencement of asphyxial symptoms. An administration of this sort suffices for the removal of one or a few teeth, opening of abscesses and whitlows and similar procedures. It has the advantage of simplicity and of practically never causing any after-effect after the return of consciousness, which is almost immediate.

The steps of the administration are as follows: The patient, whether sitting or lying, has his head in its normal relation to the chest, the neck being neither unduly flexed nor extended; in the dental chair, if not corrected, he almost invariably stretches his head too far back. A prop, quite small if the operation is not within the mouth, and for dental cases of a size to suit the operator, is placed between the teeth, the face-piece is carefully adjusted so as to exclude all air round the rim and yet not press hard upon the face, and the administrator grasps this with his left hand, keeping the little finger below the patient's chin. The right hand serves to ensure close adaptation of the mask over the bridge of the nose where air leakage is most likely. The administrator has the gas cylinders so placed that one foot, usually the left, is conveniently kept upon the footkey, and with this he has filled the bag about two-thirds full before applying the face-piece. The stopcock is so adjusted that at first air is simply breathed in and out through the open expiratory valve. By the sound which this makes it is plain that the valves are working properly and that respiration is being freely carried out. The tap is now turned on so that nitrous oxide is inhaled from the bag, expirations still passing out through the open expiratory valve. After a few breaths respiration increases in vigour and in rapidity, and the pulse, too, is fuller; slight duskiness of the features comes on, the globes of the eyes become fixed, the pupils dilated, a feeling of warmth gives way to complete unconsciousness, and this is evidenced by the peculiar jerky noise with inspirations, the characteristic "stertor" of gas inhalation. This is the moment to remove the face-piece and allow the operation to be performed. Jactitations, clonic muscular movements of hands or limbs, may precede the stertor, and these, too, must be taken as definite indication to stop the administration. Throughout the administration the anæsthetist has his foot upon the footkey and is allowing gas to flow into the bag fast enough to keep this constantly about two-thirds full. When the administration stops he carefully turns the footkey completely off and turns back the tap of the stopcock. It will be observed that if these directions are followed there is no to-and-fro breathing, the expiratory valve being open throughout. To allow to-and-fro breathing during the last few seconds of the administration, beginning just before stertor arises, by closing the expiratory valve, is a useful means of getting a rather longer period of anæsthesia. The time taken for production of anæsthesia is about one minute, but this and the amounts of gas needed vary with the physique and temperament of the patient; robust and highly nervous individuals require more, feeble and especially anæmic individuals less than the average. The conjunctival reflex is usually abolished, the corneal never.

When a longer anæsthesia is desired than that obtainable from nitrous oxide alone, the gas must be given with air or with oxygen. In the case of the latter special apparatus of considerable complexity is required, and the advantages to be gained in comparison with the use of air are not sufficiently marked to make the method worth while except for specialists in the matter. This remark applies also to the continuous administration of nitrous oxide nasally. Considerable practice is necessary to get good results with gas and oxygen or with nasal administration, though it must be admitted that, granted the necessary practice, results are obtained which cannot be rivalled in any other way. The arrangement designed by Hewitt provides the most convenient apparatus for gas and oxygen. All preliminary steps are the same as those described in the case of gas alone, and when the patient is breathing freely through the face-piece the indicator is turned from the point marked "air" to that marked "2." He is now getting a vapour of 2 per cent. oxygen to 98 per cent. nitrous oxide. The indicator is advanced till "8" is reached in about a minute, and for the average adult this is a sufficient percentage of oxygen. Anæsthesia is denoted by a quieter condition than that just described. There is instead of a jerky stertor a softly snoring sound and the complexion is only flushed, not dusky as with nitrous oxide alone. Excitement during inhalation indicates the need for less oxygen, duskiness the need for more. The available anæsthesia is longer, and there is slightly more tendency to after-sickness. If the operation is not upon the face this condition of anæsthesia can be kept up for an indefinite period, provided there are enough cylinders at hand. It is rarely advisable, however, for more than about twenty minutes, and after very long administrations sickness is apt to be almost as severe as that after ether, so that no great advantage from this point of view may be obtained. The chief drawbacks, however, are the uncertainty of producing uninterrupted muscular relaxation and the trouble of regulating the oxygen percentages with such nicety as to avoid asphyxia on the one hand, and apnœa from over-oxygenation on the other. For cases where gas and oxygen are suitable it is for the ordinary practitioner generally more convenient to employ gas and air. This he does by the use of the apparatus described above (Fig. 5). The administration proceeds exactly as described for gas alone, but after about eight breaths, at any rate before stertor or clonic movements arise, a breath of air is given by turning back the tap to the point "air" from which it started. Then three more breaths of gas are given, then another of air, and so on till the stertor is just obtained, when enough breaths of air are given to abolish it again, then three more breaths of gas are admitted, and so on for as long as necessary. The administrator aims, by admitting breaths of air, at avoiding the culminating symptoms which in an administration of nitrous oxide alone necessitate removal of the face-piece. This method of using gas is applicable to many operations where it is not essential to have complete relaxation of muscles. For instance, the removal of painful dressings, small amputations, excision of sebaceous cysts and other small tumours, are examples of cases in which it is often used with great advantage.

For breaking down adhesions in joints "gas" is not to be recommended as a rule, because of the great pain which is experienced on the immediate recovery of consciousness. Nor is it ever advisable to use this form of anæsthesia for operations involving particularly sensitive parts, unless the reflex movements which are sure to be set up do not inconvenience the surgeon. Thus skin incisions on fingers or toes, and operations involving stretching of the anal sphincter, for instance, are certain to be accompanied by reflex movement when the patient is under nitrous oxide, though of course no pain is felt. The type of subject also has to be considered; broadly speaking, the robust and the alcoholic are least well suited for the method.

Next to nitrous oxide in point of safety comes **ether $(C_2H_5)_2O$, ethyl oxide or ethylic ether.** Two kinds are available for use as a general anæsthetic, one, rectified ether, prepared from methylated spirit, with sp. gr. ·720, and the other, ether purificatus, prepared from purely rectified spirit, with sp. gr. not exceeding ·722. The latter is far more expensive than the former, and, according to some opinions, less productive of after-sickness.

Ether should be the routine anæsthetic, unless contra-indicated by the patient's condition, for all cases which cannot be met by nitrous oxide.

For the administration of ether innumerable forms of apparatus have been devised. These had for their objects the limitation of air supply and the graduation of the strength of the ether vapour. Experience, however, has narrowed down the field of choice, and practically we are left with two good methods, firstly, that which involves the use of a closed inhaler and allows of very gradual increase in the strength of ether vapour provided for inhalation, and, secondly, the open method, in which free admixture of air is permitted throughout. Broadly speaking, it may be said that the first should be reserved for short cases and the second for long. The first method has the advantage of rapidity of induction, the second that of avoiding cyanosis, congestion, great secretion of mucus and an objectionable amount of after-sickness.

For *the closed method of administering ether* the best apparatus is Hewitt's modification of Clover's portable regulating inhaler (Fig. 6). The administration is thus conducted. First, warm the inhaler by putting it into warm water for a moment. Next, with the indicator at "1," pour in 1½ to 2 oz. of ether, replace the stopper, and, putting the indicator back to "0," blow firmly through the inhaler in order to clear out any ether vapour that may be left in the central shaft. Screw on a face-piece of size suitable to the patient and arrange it in such a position that when his head is on the right side the opening for pouring in ether will be in a convenient position. Now, with the patient lying flat on his back, his head supported by one pillow and turned to the side, adjust the face-piece gently but securely to the face and fix the bag on to the inhaler. This should be done during an expiration so as to distend the bag, and during the next two breaths raise the face-piece during inspiration and press it close during expiration so as to make sure that the bag is properly distended. The patient is now breathing to and fro from the bag, and the indicator being still at "0," no ether-vapour

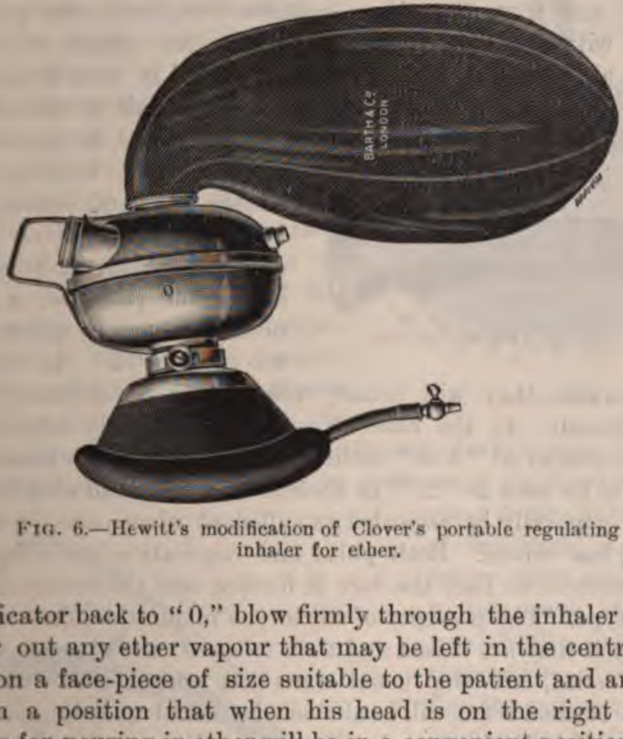

FIG. 6.—Hewitt's modification of Clover's portable regulating inhaler for ether.

reaches him. He is told to breathe in and out of the mouth from the first, and the indicator is now gently pushed away from "0" continuously but slowly, so that about a minute is taken to reach "1" and another minute to reach "2." If there is any swallowing, coughing, or holding of the breath, the indicator is pushed back towards "0." In the absence of such symptoms, which show irritation from too strong a vapour, the indicator is steadily pushed on until "F" is reached. This should take about five minutes, and by this time there should be complete unconsciousness. In most cases, however, stertor will be heard before the farthest point is reached, and as soon as stertor is heard a breath of air is to be admitted, and from that time onwards breaths of air are to be admitted with sufficient frequency to keep the colour of the face free from any considerable duskiness. It will be seen that during the induction of anæsthesia in this way no air is admitted at all, and in the case of robust subjects there must be no hurry to give the first breath, unless stertor is heard, even if the face becomes bluish. In the case of women and children and feeble patients, a breath of air should be given when the point "2" is reached, and afterwards they will usually require air about every fourth or fifth breath. In the case of men it is generally advisable to keep the indicator at "Full" until the skin incision has been made, and then to go back to "2." In the case of women and children this point can generally be regarded as sufficient when once stertorous breathing has arisen. Both pulse and respiration are stimulated by this method, so that the face is flushed and the breathing of a vigorous type. The presence of stertorous inspiration, flaccid arms, which flop if they are raised and then released, and absence of conjunctival reflex, are the usual signs that anæsthesia is complete. Later, the corneal reflex will be abolished too, and a fixed, moderately dilated pupil will be found. For all ordinary operations this degree of anæsthesia should not be reached, but for rectal, urethral and abdominal operations it may be necessary.

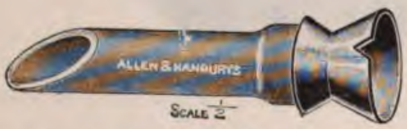

FIG. 7.—Hewitt's artificial airway.

Except in the case of alcoholic subjects there is rarely much, if any, excitement during induction of anæsthesia in this way. There is often, however, much secretion of mucus and swelling of the tongue and fauces, with spasm of the jaw muscles. For this reason, when there are accurately meeting teeth or insufficient nasal passages, a small prop should be put between the teeth from the beginning.

If this is not done there may be considerable difficulty, when it becomes necessary to open the mouth to ensure free breathing.

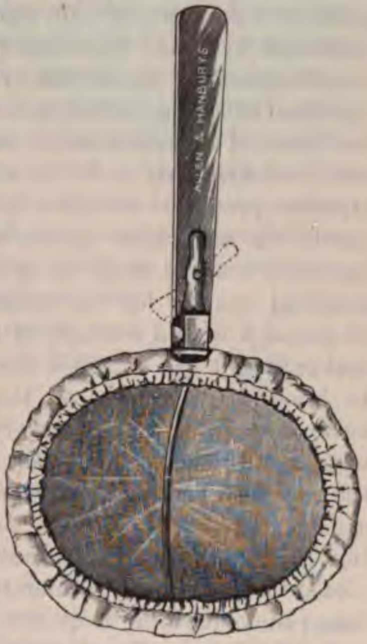

FIG. 8.—Skinner's mask.

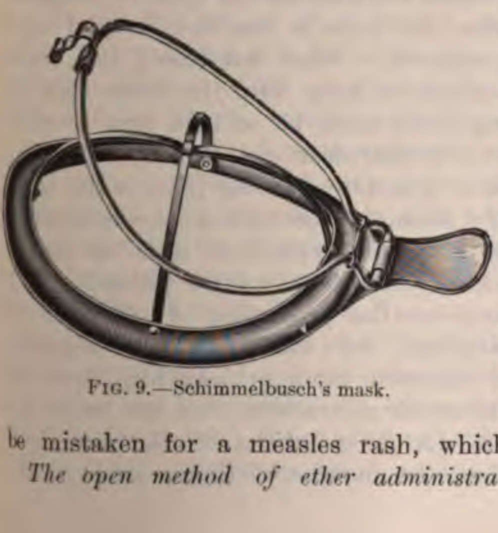

FIG. 9.—Schimmelbusch's mask.

Again, it is often necessary throughout to keep the lower jaw well forward so as to bring the base of the tongue away from the top of the larynx; and this is easily effected in most cases by pushing behind one angle of the jaw if the little prop is present as a fulcrum on which to lever the jaw forward. When this manœuvre does not succeed in keeping the airway free, the mouth should be opened by a Mason's gag and the instrument pictured in Fig. 7 inserted. The waist of the metal should be between the teeth, and the long end of the rubber tube uppermost, keeping the soft palate out of the way. Inattention to securing complete freedom of the air-way, with absence of all obstruction from a sucked-back tongue, mucus, or collapsing lips and cheeks in the edentulous, is perhaps the most common source of inconveniences during the "closed" administration of ether. Incorrect position of the head with too great flexion or extension of the neck, is another factor often giving rise to the same trouble of imperfectly performed respiration. During the first few minutes of ether inhalation a mottled pink rash often appears on the upper portion of the body and on the thighs. It lasts only for about ten minutes, but if unfamiliar to the anæsthetist may be mistaken for a measles rash, which it much resembles.

The open method of ether administration is carried out by means of a drop bottle to hold at least 8 oz. of ether, and a wire frame of the Skinner (Fig. 8) or Schimmelbusch (Fig. 9) pattern, on which are stretched eight to twelve layers of ordinary surgical gauze or two layers of thin flannel. In all cases, when not contra-indicated by some formidable consideration, such as advanced renal disease or known idiosyncrasy to the drugs, a hypodermic injection of $\frac{1}{120}$ gr. of atropine is to be given half an hour before the time of administration, and in the case of robust subjects and alcoholics this is to be combined with $\frac{1}{3}$ gr. morphia. The atropine prevents excessive mucus secretion and morphia supplements the anæsthetic properties of the ether vapour which, in its freely aërated state, as provided by this method, may not be powerful enough for the most resistant types of subject. A roll of gauze is wound a couple of times round upon the patient's face, making a soft pad on which the mask is placed, and he is instructed to breathe in and out of the mouth. A small prop is placed between the teeth if necessary. Ether is then allowed to drop upon the centre of the mask, slowly at first and more rapidly as the patient becomes accustomed to the vapour, until at the end of a few minutes the whole surface of the mask is wet with the liquid. The colour does not change to the extent seen in the closed method, the face merely becoming flushed. Care must be taken that breathing is quite freely carried out, and any swallowing or holding of the breath in the early stages generally shows that ether is being added too rapidly. About seven minutes generally elapse before anæsthesia is established in an adult male. It is shown by the three signs—stertor, absence of conjunctival reflex, and flaccid limbs—as with the closed method, but the type of respiration is considerably quieter, the pulse is less forcible and the features are less deeply coloured. After anæsthesia has been reached it is generally enough to keep only the lower half of the mask moist. The drop bottle is to be so held that a continuous drip takes place on to the mask, ensuring the constant presence of a weak vapour. A steadily dilating pupil is the sign that too much ether is being given. If there are much secretion of mucus and moist sounds with the respiration it is advisable to abandon ether. A special advantage of the open method is the efficacy with which it abolishes the production of reflex movements. In rectal operations, for instance, and dragging manipulations within the abdomen there is less likelihood of inconvenient straining or muscular contraction than can be got by the use of a closed inhaler. Larger quantities of ether are used by the "open" method and the anæsthetist should not embark upon a long operation without having at least 12 oz. at hand. In the case of an operation taking two hours or so upon a strong subject more than this may well be required. The large amount that escapes into the air is a disadvantage of the method, making the atmosphere of the room objectionable to those who are susceptible to the smell of ether. The longer an operation proceeds the less is the amount required to maintain anæsthesia, and experience, too, enables an administrator to manage with much smaller quantities than he might believe possible when new to the method. After long operations patients should be placed, when back in bed, in the sitting position and encouraged to cough from time to time. After-sickness is less than after an administration by the closed method of an equal length of time.

A convenient form of stopper which can be used in ordinary bottles for giving ether by drops is shown in Fig. 10.

Another method of giving ether, *the semi-open method*, has often been practised by the use of such inhalers as Rendle's or Allis', in which a sponge on to which ether is poured provides the vapour, mixed with a limited amount of air obtained through the top of the inhaler. The method is not one by which the induction of anæsthesia can be made pleasant, nor is it convenient for continuous administration owing to the necessity for removing the inhaler in order to pour ether on to the sponge.

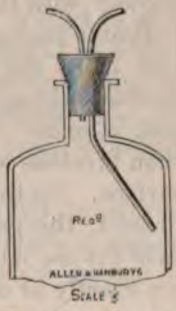

FIG. 10.—Stopper for ether drop-bottle.

In order to lessen the period of induction of unconsciousness and to save the patient from tasting ether at all while "going under," *ether is often preceded by nitrous oxide or by ethyl chloride.* Nitrous oxide is of all anæsthetics the most free from taste or smell, and the extreme rapidity with which ethyl chloride produces unconciousness makes it most serviceable sometimes in the case of highly nervous persons who wish quickly to lose all sense of their surroundings. To precede ether with nitrous oxide, an excellent routine measure for those who can have constant practice in the method, the apparatus already described (Fig. 5) is used in conjunction with the ether inhaler (Fig. 6).

The bag is fitted on to the top of the inhaler, which thus intervenes between the supply of nitrous oxide and the face-piece. No ether is inserted into the inhaler, the administration being started with the indicator at "0," the gas bag two-thirds full and the stopcock "off." Now, respiration being heard to go on normally and being indicated by the movements of the expiratory valve, the tap of the stopcock is turned "on." The administrator's foot is on the footkey, just as when giving gas alone, and the supply is kept up gently into the bag. After four breaths of nitrous oxide have been breathed 1½ oz. of ether are put into the inhaler without any removal of face-piece. The stopper is replaced, and then the patient being already partly anæsthetised with gas, the indicator is moved away from "0." Nitrous oxide is now being breathed in and drawn over ether to an increasing degree as the indicator travels towards "F."

The strength of ether can be increased more rapidly than when no gas is used, for complete insensibility to its taste has been secured by the nitrous oxide. When "2" is reached a couple of breaths are allowed with the stopcock "off." Gas is then readmitted and the indicator pushed along continuously till "F" is reached. If before this point the stertor of nitrous oxide anæsthesia is heard, or jactitations begin, then the gas is of course to be turned off at the stopcock at once. When "F" is reached this is done, and the patient then breathes air in at the open stopcock and over the entire ether surface. By this time the signs of full ether anæsthesia are probably present, the gas bag is removed and the small bag put in its place, as in the use of the inhaler for ether only, and subsequent proceedings are exactly as described for that method. Considerable practice is necessary in order to use the nitrous oxide neither too much nor too little, and though, therefore, by this method the most quiet and agreeable results are achieved in expert hands, it is not recommended except for those who can have frequent practice. Improperly used, more trouble than help is easily forthcoming from the nitrous oxide, and the additional cumbersome apparatus is another disadvantage to the practitioner.

For using ethyl chloride before ether the same inhaler is convenient, but the small bag must be fitted with a tap at its lower end, on to which a tube can be fastened containing 2 to 5 cubic centimètres of ethyl chloride. The inhaler, empty of ether, intervenes between the face-piece and bag. The administration is begun just as with ether only, but there is no ether in the inhaler, and instead of turning the indicator after the bag is duly distended with expirations, the lower end of the bag and the little tube containing the ethyl chloride are gradually raised until after four or five breaths the ethyl chloride has all escaped from the tube into the bag. Now ether is rapidly inserted, without removing the face-piece, one breath of air is admitted and then ether is rapidly given by pushing on the indicator. For women 4 cubic centimètres, for children 2, and for men 5, should be regarded as the maximum doses of ethyl chloride to be used in this way. Unconsciousness is usually present after four inspirations if the bag is raised to at least the level of the mouth, and it is important to give a breath of air early. There is commonly no stertor showing unconsciousness with ethyl chloride and the colour of the face does not change markedly. Fixed globes of the eyes, dilated pupils and absent conjunctival reflexes show the presence of anæsthesia. When the indicator reaches "F" the bag is to be removed and squeezed so as to drive out any remaining ethyl chloride, replaced, and the administration continued as with ether only. This method is rapid and efficacious, but is best reserved for alcoholic subjects or those who would be likely to be refractory to nitrous oxide or to ether alone. Many persons find the close face-piece of an inhaler objectionable. When it is desired to give "closed" ether to any such subjects the induction should be begun by chloroform or C.E. mixture in the manner described later, and as soon as unconsciousness is reached the closed inhaler may be put upon the face with the indicator at "1," and this rapidly pushed along until ether anæsthesia is established.

A good test for the advent of unconsciousness is to tell the patient in a loud tone to raise his hand. If no movement is made it may be taken that unconsciousness has arrived, for hearing is the last of the special senses to be abolished.

Chloroform ($CHCl_3$, trichlormethane, bichlorinated chlorate of methyl) is the most potent, and for that reason in some cases the most convenient, anæsthetic at our disposal. Chloroform for anæsthetic purposes should be colourless and transparent, neutral to test paper, and have a specific gravity between 1·49 and 1·495. The conveniently simple apparatus by which it may be given and the comparatively small amounts that have to be carried should not, however, blind us to the dangers of chloroform, which are much more easily evoked than those of the anæsthetics hitherto considered. For this reason *chloroform should only be used when there are distinct obstacles to the use of one of the less dangerous drugs.* It is true that by the use of apparatus which definitely regulates to a very low point the percentage strength of chloroform vapour inhaled, the danger of this drug is minimised. Yet such apparatus is at present not portable enough for use outside the theatres of institutions, and the objections to the routine use of chloroform in general practice remains. This danger is much lessened if the administrator has been able to learn, by *the use of regulating apparatus* in a hospital, the central fact concerned in securing safety with chloroform. This fact is the necessity for a continuous administration of a weak vapour, a vapour whose maximum in inducing anæsthesia should be about 3 per cent., and in maintaining anæsthesia about 1 per cent. There is with chloroform no question of a closed inhaler as in the case of ether, for the former drug being about seven times as potent as the latter, safety with it is only possible when a very free admixture of air is practised, an admixture so free that the percentage of chloroform to air never exceeds about 3 of the former to 97 of the latter. To obtain this accurate limitation of chloroform vapour two kinds of inhaler have been devised. In the one kind, those on the "plenum" system, an indefinite amount of a vapour containing chloroform and air in the proper percentages, with an upward limit of 3, is constantly supplied to the patient. He is in no way dependent upon his respiration for the amount of chloroform vapour reaching him, this being constantly pumped into the face-piece by mechanical means. These machines, then, when accurately constructed, leave no opportunity for overdosing by the supply of too strong a vapour. The best specimens of this kind of apparatus are the Dubois, Waller's balance, the Roth-Drager apparatus, in which, however, oxygen replaces air, and Alcock's apparatus. Junker's apparatus may be regarded as belonging to this class, although it does not approach the others in accuracy of percentage vapour supplied to the patient. With the exception of the Junker, the use of which is described later, none of these machines are convenient for use except in the operating theatre. In the other kind of regulator, which works on the suction action system, the supply of chloroform vapour depends upon the patient's own respiration, which acts as the pump, and the percentage strength only is regulated by the mechanism of the inhaler. There are obvious disadvantages to such a system, but the advantage is that, no driving mechanism being required, the apparatus can be made portable. The best known instrument of this kind is the Vernon-Harcourt inhaler. None of these instruments being, in the writer's opinion, advisable for general use outside institutions, they are not here described in detail, it being supposed, however, that the reader will learn the principles of chloroform inhalation by their help.

These principles being mastered, he can adopt in actual practice *the more convenient methods of giving chloroform* now to be dealt with. Perhaps the most generally suitable is that by means of a *drop bottle and mask*. The mask (Figs. 7 and 8), must be a simple frame covered with one layer of thin flannel or domette. The drop bottle should hold at least 2 oz., and must be capable of delivering the liquid either in single drops or in a continuous stream; the kinds known by the names of Thomas and of Hewitt answer these requirements well. The mask is to be held at a short distance, about 2 inches, from the face, and it is most important to remember that since safe dosage depends upon free admixture of air, the mask should never be allowed to rest upon the face. In this way, even though chloroform is very freely poured upon the mask, a layer of air intervenes between it and the face and ensures a dilution with air which will keep the vapour inhaled of a strength almost within the safe limit of 2 per cent. of chloroform. For the first few breaths after the mask has been placed before the face nothing should be put on to it, the patient being quietly encouraged to draw his breath in and out of the mouth. Then a very few drops of chloroform are allowed to fall upon the centre of the mask, and, respiration going on smoothly, drops are allowed to fall continuously over an increasing surface of the mask, till at the end of five minutes a third of the surface of the mask is kept moist with chloroform. Any holding of the breath or rigidity of limbs or sitting up movements are met by a steady continuing of the same weak vapour, the administration only being interrupted for a moment to allow of brisk rubbing of lips and cheeks to stimulate breathing. If, when consciousness has gone, there is violent muscular excitement and holding of the breath, ether in a closed inhaler may be temporarily substituted for the chloroform. There is to be no rapid increase of dose in order to quell excitement or movements, and for an adult at least six minutes should be taken to secure anæsthesia. That this is reached is shown by the regular automatic breathing with soft stertor or snore, absent conjunctival reflex and flaccid limbs. The pupil usually enlarges during induction and settles down to a size smaller than that seen with ether when surgical anæsthesia is established. The corneal reflex should be weak but distinctly present, and it should only be abolished in the case of operations upon especially sensitive parts or upon the abdomen. The colour of the face is little altered from the normal and the pulse and respiration rates are but little faster than those of normal sleep. As time goes on the colour of the face becomes rather paler than normal. There is thus a much quieter condition than that seen with ether, no congestion of face, no secretion of mucus and saliva and a gentler form of respiration and less forcible pulse. This quiet state is often accentuated just before the onset of retching or vomiting. In such cases the pallor is more marked, the respiration is very shallow, and the pupil may dilate. To distinguish such a condition from that due to an overdose of chloroform we have the fact that in the lightly anæsthetised patient who is about to vomit the corneal reflex will respond to stimulation, whereas when overdose is present the lids will be inactive. Also in the former condition the pupil, though dilated, will react to light, which is not the case with the pupil dilated from excess of chloroform. The imminence of vomiting is to be treated by brisk rubbing of the face and lips so as to stimulate respiration and the gradual increase of chloroform upon the mask. The head during inhalation of chloroform should never be much raised above the level of the shoulders; one pillow generally provides the proper elevation, the shoulders being flat upon the table. A patient's condition may change very rapidly during chloroform inhalation and there should be constant close watchfulness on the part of the administrator. His best guide to safety is to hear every breath, or if this is impossible he should take steps to feel that the respiratory movements are going on properly, by placing a hand over the lower chest or epigastrium.

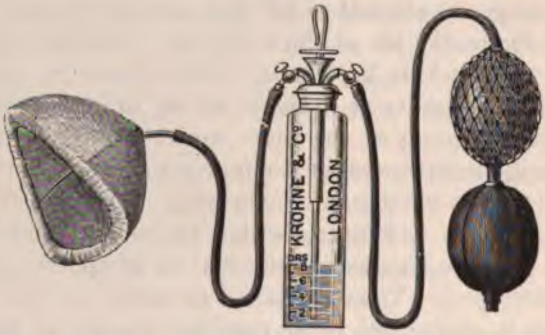

FIG. 11.—Junker's inhaler for administration of chloroform.

It is important to remember that when once anæsthesia has been established a very weak vapour of chloroform, if continuously given, is enough to maintain it, and that in the course of a long operation even this weak vapour should be reduced in strength. Thus, by the use of regulating inhalers, we find that as little as ½ per cent. of chloroform often suffices to maintain anæsthesia during long operations within the skull and even within the abdomen during certain stages of the operation. The administrator must vary his dosage with the surgeon's requirements of course, but in cases, such as gastro-enterostomy, for instance, a very weak vapour is enough during the stitching together of the stomach and bowel, whilst a deeper anæsthesia is required when the abdominal walls are pulled upon to allow of the return of the viscera.

Next to the drop-bottle and mask method the most convenient way of giving chloroform is supplied by *Junker's inhaler* (Fig. 11). This inhaler provides a nearer approach to accuracy of percentage composition of vapour and greater facility for keeping the strength of vapour at a constant level than is easily obtainable by the drop-bottle method. Care is to be taken that the indiarubber tubes are properly connected, for if that which should be connected with the pump is by mistake connected with the face-piece, liquid chloroform may be pumped on to the patient's face. The same may occur if the bottle is overfilled or allowed to tilt. It is hung by a hook from the administrator's gown, and should remain always nearly vertical. Not more than 1 oz. of chloroform is to be put into the inhaler; the face-piece, which should be a metal frame covered with a single layer of linen, flannel, or domette, is lightly applied to the face, the patient being asked to breathe quietly in and out of the mouth; a very gentle pressure is applied to the pump during each inspiration. By testing the inhaler upon himself the anæsthetist will realise how very gentle a squeeze must be given to the indiarubber ball at first. As the patient gets used to the vapour the squeezes may increase in strength, but the ball should not be fully compressed. Moreover, care must be taken to squeeze only as the patient inspires. At least ten minutes should be taken to obtain anæsthesia with an adult. The inhaler is so made that the vapour driven into the face-piece by a full compression of the ball cannot exceed about 3 per cent. Whether the Junker inhaler is used or not in ordinary cases, it is most suitable for administering chloroform during long operations within the mouth or nose. For this purpose the face-piece is replaced by a metal tube (Fig. 12), when the chloroform is to be given through the mouth, or through a tracheotomy tube, and by a nasal catheter when it is to be given through the nose. In such cases

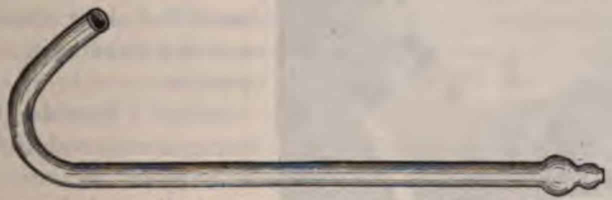

FIG. 12.—Metal tube for use, with Junker's inhaler, in mouth or tracheotomy tube.

the requisite anæsthesia is first to be obtained in the ordinary way best suited to the individual case, and then the Junker tube substituted for continuation. When the mouth tube is being used it is important to ensure that the patient breathes through the mouth only, and for this purpose it is generally necessary to block the nostrils by inserting a few inches of ribbon gauze. Otherwise there may be difficulty in maintaining proper anæsthesia in full-coloured individuals who so commonly supply the subjects of tongue operations. When the nasal catheter is used it must be inserted carefully during full anæsthesia. Before the operation begins the administrator must pass a finger to the back of the pharynx and make sure that the end of his catheter is just over the opening of the glottis. A small piece of tubing slipped over his catheter to the nostril will serve as a mark and show him that his catheter remains in its proper position.

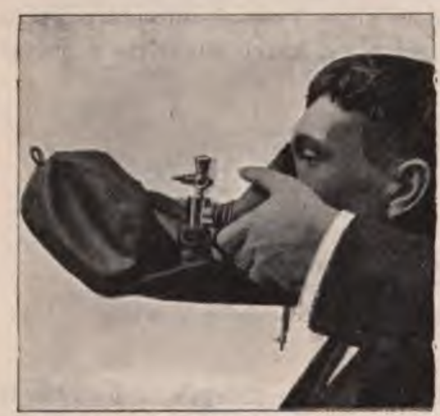

FIG. 13.—Administration of ethyl chloride from small bag and face-piece.

Ethyl Chloride (C_2H_5Cl), being a very volatile liquid, is supplied for use in hermetically sealed glass tubes, from which it is released in the form of a spray by pressure of a spring-tap. The tubes supplied by Duncan and Flockhart are convenient. The label on the tube should state that the contents are intended for general anæsthesia. Less pure forms of the drug, for local anæsthetic purposes, are supplied in similar tubes and are not fit for inhalation. Ethyl chloride is serviceable for short operations when nitrous oxide is not available or does not suit the case. It is not to be used for prolonged operations, having then no advantage over ether or chloroform, and not being capable of continuous administration. Its portability and the simplicity of apparatus with which it can be given render it highly valuable as a substitute for nitrous oxide in country practice. When the latter, however, can easily be obtained its greatly superior safety should give it the preference.

Ethyl chloride is a potent drug, and has been responsible for many fatalities before its powers were fully realised. Moreover, it produces unconsciousness with startling rapidity and with only slight symptoms, so that the administrator must be on his guard not to continue unnecessarily and thus give an overdose. It should be used in the same kind of way as nitrous oxide alone, *i.e.*, as an anæsthetic with which a full dose being given, a short anæsthesia is obtained and the anæsthetic is then removed. Used in this way an anæsthesia of two or three minutes may often be obtained by a single administration of ethyl chloride.

The following I have found a satisfactory mode of procedure. The small bag of an ether inhaler is fitted on to the face-piece. The bag has the horizontal limb of its angle piece continued into a small funnel fitted with a tap (Fig. 13). The dose of ethyl chloride, 2 cubic centimètres for a small child, 4 cubic centimètres for a woman, and 5 cubic centimètres for a man, is squirted into the funnel and the tap then turned off. The face-piece is gently applied to the patient's face, the bag hanging down. For the first two breaths the expirations are caught in the bag, the face-piece being just lifted from the face during inspiration. The patient is asked to breathe gently only, a small prop having first been placed between his teeth. Now, with the third breath start to raise the level of the bag so that by the sixth breath it is held out horizontally in a line with the patient's face and he is breathing freely in and out of it. By the seventh breath, which is the fifth of ethyl chloride, he will in most cases be unconscious. Give one breath of air, then allow three more breaths of ethyl chloride, then remove the inhaler and allow the operation to be performed. The usual signs of anæsthesia are: fixity of the globes of the eyes, insensitive conjunctival reflex, flushed face and sometimes stertor. Usually the limbs are relaxed, but they are often rigid at first, and there is usually some spasm of the jaw muscles, for which reason the mouth prop is always inserted before starting the administration.

Besides its use as a preliminary to ether, ethyl chloride is sometimes given as an introduction to chloroform or its mixtures. In such cases, when the ethyl chloride is sprayed upon the open mask, it is not attempted to produce full anæsthesia with this agent, but merely rapid insensibility. In such manner it is often highly serviceable in rapidly stilling a crying infant whose alarmed parents are present. When used in this way the ethyl chloride is to be sprayed upon the mask before this is put near the patient's face. There is not the same need for strictly limiting the dose as when ethyl chloride is used from a closed inhaler, for the free admixture of air and the volatility of the drug makes overdosage highly improbable.

Anæsthetic Mixtures with Chloroform as their Chief

Ingredient are useful agents. The best known, perhaps, is the *A.C.E. mixture*, which consists of alcohol, chloroform and ether in the proportions by volume of 1, 2 and 3. It has no advantages, however, over and is less simple to prepare than the *C.E. mixture*, made of 2 volumes of chloroform to 3 of ether; used in the manner to be now described, there is no object in adding alcohol, which used to be included when mixtures were given from an inhaler, in order to ensure the equable evaporation and prevent the more volatile ether being inhaled first and practically pure chloroform later. Various other proportions of chloroform and ether, and of chloroform and alcohol, have been used, but the reader is recommended to use only the C.E. mixture and to prepare it himself by shaking together 2 oz. by volume of chloroform with 3 oz. of ether. He is then to use the mixture according to the principles by which he administers chloroform. That is to say, C.E. is to be given gradually and with free admixture of air, no inhaler is to be employed, an open mask, Skinner's or Schimmelbusch's, covered with one layer of thin flannel or domette and a drop bottle holding at least 3 oz. of the mixture, being the necessary apparatus. A single layer of a roll of gauze is placed upon the face and the mask allowed to rest upon this. The mixture is then added drop by drop, the patient being encouraged to breathe freely in and out of the mouth. Drops are added so slowly during the first minute that only twenty should be used in this time; as the patient gets accustomed to the vapour the rate of dropping is increased, till at the end of six minutes the surface of the mask is moist with the liquid. When the incision has been made it is no longer necessary to keep more than the lower half of the mask wet, and with women and children even considerably less than this. The symptoms evoked by this mixture are a compromise between those of ether and of chloroform. There is less congestion and mucus than with the former, less tendency to pallor and to laryngeal stridor than with the latter. The pupil is larger than that usual with chloroform, smaller than that usual with ether. Overdosage, however, is easily achieved and is accompanied by the same phenomena, failure of respiration with pallor, as are shown in chloroform overdose. The administrator, in fact, is recommended to regard the mixture for practical purposes as being a diluted chloroform and to exercise all the close watchfulness which this drug demands. The mixture is an extremely useful routine anæsthetic, safer than pure chloroform, more generally applicable than pure ether. For ordinary operations the absent conjunctival reflex, flaccid limbs, snoring or gently stertorous inspirations, are the proper signs that the patient is ready. Only for special purposes, as with rectal and abdominal operations and those upon fingers and toes, is the corneal reflex to be abolished.

THE PRINCIPLES UPON WHICH THE CHOICE OF ANÆSTHETIC IS MADE.

In discussing the choice of anæsthetic and method of administration for various cases we shall assume that the administrator is expert in all. For him who only occasionally administers anæsthetics it is better, however, to perfect himself in the administration of one agent which can be used for all cases, even though it will not, of course, always be the best possible anæsthetic to use. He will get better results by always using an anæsthetic to which he is accustomed than he will by choosing for special cases that which is best if in accustomed hands, but with which he is himself unfamiliar. The most widely applicable anæsthetic is the C.E. mixture, and we recommend the practitioner to make himself familiar with this and to use it in all cases. For the anæsthetist who is not confined to one routine anæsthetic there are four main principles to guide his choice. He must consider, firstly, the safety of the patient; secondly, the nature and site of the operation to be performed; thirdly, the convenience of the surgeon; and fourthly, the comfort of the patient.

To ensure the safety of the patient his general condition has to be considered. Suppose, for instance, that he is the subject of **emphysema and bronchitis** and is to be operated on for a strangulated hernia. Although so far as the operation is concerned we have seen that ether is the safest anæsthetic to choose, yet in such a case as this the subsequent effects upon the lungs would very probably be disastrous. The C.E. mixture or pure chloroform would be the proper anæsthetic to give, supplementing this with pure ether on the open mask only if there were grave symptoms of circulatory failure upon the table. **The general condition of a patient, his physique and his temperament,** play a large part in deciding the best way in which he can be safely and comfortably anæsthetised. Moreover, the experienced anæsthetist foresees difficulty in persons who, to the uninitiated, would appear first-rate subjects, whilst those who would appear most fraught with anxiety to the inexperienced are frequently just the easiest cases to manage. Thus the strong, ruddy-faced open-air individual, be he navvy or drayman, hunting-man or naval officer, with his highly developed muscular system, strong neck and jaws, the picture of health, for whom the inexperienced would pronounce most favourably as regards anæsthesia, is the very individual with whom the greatest trouble is likely to be experienced. The initiated knows that in such persons a period of spasmodic contraction of muscles, particularly those of the neck, jaws and lips, is most likely to arise during induction of anæsthesia, that such spasms will be accompanied by clenching of the teeth, swelling of the tongue and fauces, and if the proper steps are not taken arrest of respiration. He knows that if any closed system of etherisation is used the teeth must be separated beforehand by the insertion of a prop and that frequent breaths of air will be necessary to avoid extreme cyanosis; at the same time he knows that such an individual will require large amounts of ether to procure anæsthesia at all, and the expert will probably prefer to start with a stronger anæsthetic such as C.E. mixture, using his loaded ether inhaler only when consciousness has gone and the spasmodic stage arrives. Moreover, whereas the novice, realising perhaps the difficulty of ether in such a case, would rush to chloroform, the expert knows that it is just in these very muscular individuals that fatalities occur with chloroform during the early stages. Respiration being stopped by spasm, a strain is thrown on the right side of the heart, which is unrelieved by the temporarily inactive lungs, and the chloroform-laden blood, acting upon the dilated cardiac wall proves too much for its vitality so that sudden syncope results.

Again, those who are accustomed to the free use of alcohol or to allied narcotic drugs are particularly resistant to the effects of anæsthetics. They require unusually large doses of anæsthetic and are especially subject to the occurrence of reflex movements of the limbs, even during deep anæsthesia. For these subjects, again, the inexperienced might be tempted to use chloroform freely. The hearts of such subjects may, however, frequently be affected by fatty changes, and safety lies in the judicious use of ether in such cases, although to make it effective there will often be required the preliminary injection of morphia and atropine. Apart from the general physique of the patient, or his habits as regards drugs, what may be called his nervous condition also plays a pronounced part in determining his behaviour towards anæsthetics. Thus the frail individual who would appear to be an extremely easy subject to anæsthetise may, if of a highly strung, nervous or hysterical nature, offer much the same difficulties that are more commonly met with in the alcoholic subject. The same length of induction, and the same tendency to reflex movements, even when under full anæsthesia, are sometimes met with in such persons. It is in the case of such persons that there is particular advantage in the preliminary use of a hypodermic injection of morphia with atropine or scopolamine, whatever the subsequent agent employed.

Patients who are already in a condition of **drowsiness,** whether from the taking of a drug or from the presence of cerebral tumour or abscess or after an accident to the head, require little anæsthetic. As a rule, in such subjects deep anæsthesia is required only for the initial incision, after which minute quantities only are to be employed. When **dyspnœa** is present, if this is due to any mechanical narrowing of the air passages, whether it is in the larynx from diphtheria, in the trachea from compression, or in the bronchi or lungs from affections there, the indication is strongly in favour of the use of chloroform. Ether, by increasing the swelling and secretion of mucous membranes, increases the dyspnœa in such cases. When the complexion is dusky, oxygen should be used throughout with the chloroform. Cases of **acute cellulitis of the neck,** accompanied, as it often is, by some œdema of the glottis, are always dangerous for anæsthesia. No closed apparatus is to be employed, but a light C.E. anæsthesia, with the patient lying upon the side, gives the best chance for safety. **Patients in whom the thorax is rigid and immobile,** as is often the case in emphysema and bronchitis, are also not suitable subjects for the use of ether, which is likely to be associated with much coughing and cyanosis. Chloroform is the most suitable anæsthetic, though C.E. may often be used with perfectly satisfactory results. In such cases as these oxygen is often to be used with great advantage along with the anæsthetic. When there is much distension of the abdomen, whether from a large tumour or ascitic fluid, the movements of the diaphragm being impeded and breathing being carried on mainly by the chest, no closed system of anæsthetising is advisable. Such patients usually do very well with open ether or with C.E.

Cases of **valvular disease of the heart,** provided that there is complete compensation, are to be treated on ordinary lines. When compensation is broken down and particularly when there is orthopnœa, the matter is different, and much care is necessary. A light anæsthesia with C.E. mixture is generally best, and oxygen may often be used concurrently with advantage. "Gas and ether" should be avoided, and if these patients are to have a short operation under nitrous oxide, oxygen is to be freely used in conjunction with the gas.

Cases of **tachycardia,** as in Graves' disease, are fraught with extra risk in anæsthesia. Open ether, after a preliminary injection of morphia and atropine, is the safest method, and only a light anæsthesia should be maintained after the skin is cut through.

The psychical element plays a large part in Graves' disease, and it has been recommended that these patients, before undergoing operation, should be acclimatised, so to speak, by short daily interviews with the anæsthetist, when he would accustom them to breathing with the mask near the face and would encourage them to undergo the preliminaries without concern. Crile, who practises this plan for three or four days before operation, also uses a solution of cocaine freely all over the operation area.

Cases of **renal disease**, with much albuminuria, are held to do better under chloroform than under prolonged etherisation. With ether there is also a risk of subsequent pulmonary œdema in persons whose kidneys are seriously affected.

Diabetes, if sugar is abundant, provides extra risk by reason of the liability of coma to follow anæsthesia. The risk is not peculiar to any anæsthetic, but is probably highest with chloroform. These patients are to be dieted beforehand and every effort made to reduce the sugar as much as possible before operation. As little anæsthetic as is compatible with the surgeon's needs is to be used for the operation. Amputation in such cases has been successfully performed under a combination of cocainisation of the nerve trunks under local anæsthesia with the administration of nitrous oxide and oxygen for the actual amputation.

Pregnancy is no bar to anæsthesia if an operation is necessary during this period. The later in pregnancy that an operation takes place the greater is the risk of abortion ensuing. The risk is reduced to its minimum so far as the anæsthetic is concerned by avoiding all cyanosis and clonic convulsive movements. Therefore, free air admixture is prudent with whatever anæsthetic is used, and if nitrous oxide is employed it is freely diluted with oxygen.

Operations during the **menstrual period** are generally avoided if possible, but in cases of urgency this complication is disregarded and does not seem prejudicially to affect the result.

In all cases of **exhaustion**, such as is seen in the subjects of gastric cancer for instance, anæsthesia is induced and maintained with great ease, and care has to be taken not to use excessive amounts of anæsthetic. The feebleness of such patients is best helped by using ether and by employing it in an open way. Similarly, in patients suffering from **shock**, as after a grave accident, or in the condition of **collapse** that accompanies advanced acute peritonitis, much care is necessary. The first effect of the anæsthetic is to improve the circulatory condition, but this improvement is apt to be followed by collapse more serious than at first. The anæsthetic, which in such cases should be ether, is to be used as sparingly as possible. Subcutaneous infusion of normal saline into the loose cellular tissue of the axilla, is to be carried on during the whole of the administration, and is often continued with advantage when the patient is back in bed.

It is sometimes necessary to give anæsthetics to the subjects of **epilepsy**, and no special precautions are necessary. A seizure is occasionally, but rarely, evoked by the inhalation. Similarly, persons subject to recurring attacks of **insanity** are liable to have an attack on recovery from anæsthesia. The insane, unless of a furious type, are commonly anæsthetised without much difficulty.

In the management of **infants and young children** there is, perhaps, more than under any other circumstances, opportunity for the exercise of tact and skill on the anæsthetist's part. The first essential is to avoid frightening the patient in any way, and by a cheerful matter-of-fact kind of manner to make it appear that the child is about to indulge in a new game rather than undergo any process in the least likely to be unpleasant. The child should remain in its bed, where the anæsthetist sits beside it, and chatting to it and allowing it to play with the mask, he then shows how this is used, and gradually introduces small but increasing doses of C.E. into the game. In this manner young patients can generally be talked and coaxed into drowsiness, after which ether may be substituted, or the C.E. continued with, as thought best. The idea that chloroform is without danger for children is an exploded one. They inhale it certainly with ease, and there is no spasm set up as in the case of muscular adults, but many a catastrophe associated with the operations of circumcision and of "tonsils and adenoids" has borne witness to the fact that its powers for harm are just as great with children as with adults. A few drops on the mask at the beginning of the inhalation are often advisable, but it is rarely wise to maintain deep chloroform anæsthesia in the case of children.

Aged persons are good subjects for anæsthetics, inasmuch as they are easily anæsthetised. Generally speaking, chloroform is best suited to them, their respiratory apparatus being unfit to respond to the requirements of ether.

The condition known as **status lymphaticus** in which, with enlargement of the thymus, there is presence of enlarged lymphoid follicles and glands generally, has often been found in the bodies of those who have died during anæsthesia, and is held to play a determining, though obscure, part in the fatality. The clinical evidences of this condition do not allow its certain detection beforehand, but the anæsthetist will be wise to be particularly on his guard when the patient is a child or growing adult of slight physique though good height, pale complexion, timorous disposition, with large tonsils and adenoids. If the spleen is palpable, and there are palpable enlarged cervical or abdominal glands, apprehension becomes still better founded. Lymphoid follicles visible on the epiglottis and much enlarged papillæ at the back of the tongue are also evidences suggestive of the condition. Ether is the right agent to employ in such cases, for it is remarkable, if the condition itself is mainly responsible for the fatalities, that these have never yet occurred during the use of ether.

ADMINISTRATION IN CERTAIN SPECIAL OPERATIONS.

The choice and management of the anæsthetic so far as it depends upon the *nature and site* of the operation must now be considered. Firstly, with regard to **operations upon the face and about the mouth, nose, tongue and jaws.** The quite short operations will be done under nitrous oxide, with air or oxygen, or under ethyl chloride, one administration being given and the apparatus then removed. Cases requiring a few minutes are best managed by obtaining a full ether anæsthesia and then removing the anæsthetic for good. A period of quiet unconsciousness lasting for several minutes can be relied on if the patient is allowed to imbibe ether for four or five minutes after anæsthesia is induced, before the anæsthetic is finally removed. In all operations where blood flows in such a way as to have access to the larnyx, as, *e.g.*, the operations upon the tongue, for tonsils and adenoids, for intranasal spurs, upon the antrum, etc., *the position of the patient* is a question of much importance. Different surgeons prefer different positions: naturally the anæsthetist must accommodate himself to that position in which the surgeon can do his work best. In doing so, however, the anæsthetist must bear in mind one main principle. If the position demanded by the surgeon is one which enables blood to enter the larynx, then either the anæsthesia must be kept so light that the coughing and swallowing reflexes are not abolished, or else there must be frequently repeated sponging out of the pharynx. Such measures are necessitated by the dorsal position with the patient horizontal and the head in the middle line, and by sitting positions when the head is straight. When the patient is placed upon his side or even if he is on his back with the neck turned well to one side, and the opposite shoulder a little raised, all blood flows into the dependent cheek, and a deep anæsthesia may be maintained with safety.

For operations upon the tongue it is necessary to get deep anæsthesia in order that the arranging of the gag and of the patient's position can take place without recovery commencing. This first stage is usually best accomplished by the use of C.E., though if there is nothing in the patient's build or condition against it there is no objection to using gas and ether, or ether alone. When the gag has been inserted, and all is ready for beginning the operation, anæsthesia is to be maintained by chloroform given from a Junker's inhaler through a nasal catheter or mouth tube. The nasal catheter is generally more convenient, and the anæsthetist must insert it into one nostril and make sure, by means of a finger in the posterior nares, that the end of the catheter projects into that space. This is to be done carefully before the operation begins, and is another reason why a good anæsthesia is to be first obtained, as these manipulations and settling the gag as required will take a little time.

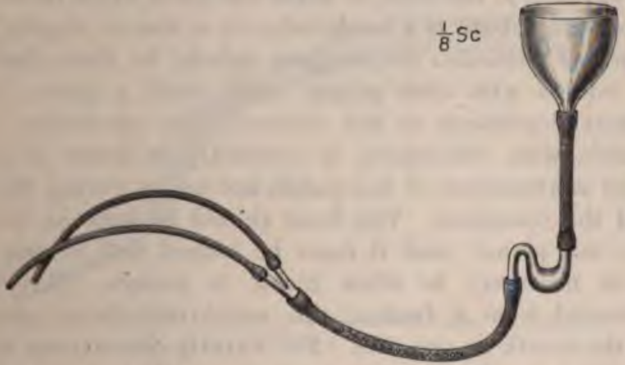

FIG. 14.—Crile's apparatus for use of ether in tongue cases.

The depth of anæsthesia during the operation will depend as above described on the facilities presented for escape of blood without its entering the air passages. If there is any risk of this, a light anæsthesia which permits of coughing and of swallowing is to be maintained. When a preliminary laryngotomy or tracheotomy is performed, the anæsthetist's task is much lightened. He keeps up anæsthesia by working the end of his soft metal tube into the opening of the tracheotomy tube, into which he pumps his chloroform vapour from a Junker's inhaler. The surgeon arranges by the use of a sponge or of a Hahn's or Trendelenberg's tube that no blood shall enter the trachea. At the moment when the trachea is first opened there is often a short period of apnœa, and the insertion of the tube may give rise to coughing or holding of the breath. Respiration is generally very quiet through the tracheotomy tube, and the anæsthetist will often keep one hand lightly on the epigastrium to inform himself that breathing continues to go on efficiently. These and similar operations may be performed under ether by the use of Crile's apparatus (Fig. 14). A preliminary injection of morphia ($\frac{1}{6}$ gr.) and atropine ($\frac{1}{120}$ gr.) is given, the tubes are inserted so that their tips overhang the glottis, the pharynx and pharyngeal aspect of the epiglottis and larynx are brushed with a 2 per cent. cocaine solution, and the pharynx is packed with sterilised gauze. Ether is dropped upon the flannel covering the funnel. The method is invaluable for long operations upon feeble subjects.

In **the operation for cleft palate**, chloroform is generally the only anæsthetic admissible. The congestion and the saliva and mucus clinging to the pharynx make the use of ether objectionable, but when the patient is a feeble infant it is wise to employ some in the course of induction despite these defects, for these feeble, pale, ill-fed infants with cleft palates often reach a grave degree of circulatory depression in the course of the operation. A deep anæsthesia with chloroform is necessary in order to avoid all awkward contractions of the palate and fauces during the delicate steps of the operation. The head should be kept as low as the surgeon can permit, and it must be turned well to one side as often as necessary to allow blood to escape. Chloroform is administered from a Junker, the metal tube being placed well within the mouth on one side. For **harelip operations** continued anæsthesia is kept up in this same way. Here, however, a good open ether or C.E. anæsthesia may be first induced, and often this suffices for the performance of the operation. The Junker tube must be at hand, however, to continue with if necessary.

Removal of tonsils is commonly done rapidly. When this is to be the case nitrous oxide and oxygen usually suffices, and the patient may be in the sitting or lying position according to the operator's wishes. A small dental prop or a Doyen's gag is to be inserted before beginning the administration, and when the face-piece is removed, the administrator helps by steadying the gag and pressing forward the tonsil to be removed from behind the angle of the lower jaw. For small children ethyl chloride is the most suitable anæsthetic when this operation is to be done rapidly, and adenoids, too, may be removed, under one dose of this anæsthetic, by an expert operator. Immediately the operation is over the child is turned completely over on one side, or on to its face with the head overhanging the edge of the table. All blood escapes safely in this manner, and the gag is not to be removed until there are plentiful signs of the return of consciousness. For operators who like to be more deliberate a full ether anæsthesia is to be provided, and for those who like longer still this is to be supplemented by chloroform from a Junker, just as in tongue or long intranasal operations, the same precautions for the escape of blood by arranging of position and depth of anæsthesia being observed as in those cases. In hospital work the short anæsthesia of gas and of ethyl chloride is invaluable and practically inevitable for these cases, but in private practice it will be found most desirable to get a full period of quiet anæsthesia, so that the operator need not be hurried at all, and the child may be removed to bed while still drowsy. Then vomiting of any swallowed blood is to be encouraged by gently opening the mouth and tickling the pharynx with the forefinger. If, after any of these operations, there are signs of blood in the air passages, as, *e.g.*, moist sounds with respiration, the patient is to be laid on alternate sides at intervals of half an hour.

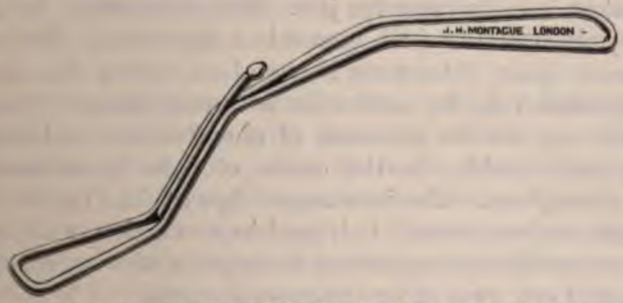

FIG. 15.—Longhurst's combined chloroform tube and tongue depressor.

Operations upon the antrum are performed according to the principles just described, and as it is important not to open the mouth too widely, a small dental prop on the side away from the affected antrum, the head being turned also away from that side, is generally most convenient. For the extraction of many teeth a full ether anæsthesia generally suffices, but if necessary this is to be supplemented by a Junker, as in tongue cases. It will be found convenient to pack a sponge firmly into the side which has already been cleared when the operator proceeds to the extractions on the other side. When sponging is necessary in any of these operations its performance often falls to the lot of the anæsthetist. He should be provided for the purpose with several firm, round, largely honeycombed sponges, and should use them without a holder. Whenever the sitting position is used in any of the above operations chloroform should be avoided unless the administrator is thoroughly expert.

Excision of the Eye is best performed under ether. In other ophthalmic operations chloroform is generally desirable to avoid the conjunctival congestion caused by ether, but this may be well used for induction, a chloroform anæsthesia being gradually established and the operation then performed during its use. The anæsthetist is generally occupied during these operations in supporting the chin to keep the tongue away from the larynx, over which it tends to gravitate, the head being in the middle line in these cases. It is well, therefore, to insert a small prop rollerwise between the front teeth, so as to have this as a fulcrum to work against in supporting the jaw. The same step is generally necessary in operations for removal of **glands of the neck,** in which cases, again, chloroform is often best during the operations, although ether may be used with advantage first. There is an extra tendency for the secretion of much mucus and consequent retching and vomiting in the course of these operations if ether is used throughout. The instrument figured in Fig. 15 is very serviceable in these cases. It is used in connection with Junker's pump and enables the anæsthetist to keep the airway clear and to keep himself well away from the operation area.

In **operations for empyema** and other conditions within the chest any closed apparatus is generally to be avoided. There is generally some dyspnœa, and plenty of air and, in bad cases, oxygen is to be given with the anæsthetic. What this should be depends mainly upon the patient's general condition, but C.E. is most often the requisite agent. Position is of much importance, for the lung of the affected side being of little or no use, it is essential that the sound side should be given free play. On the other hand, the surgeon's requirements often demand that the patient should lie at least partly on this sound side to give him free access to the affected side. The anæsthetist must make sure that respiration is not seriously hampered by the position and, at any rate, during induction of anæsthesia must keep the good side quite free. Change of position, if necessary, is then to be slowly effected, and any effect upon the breathing noticed and action taken accordin
If the patient is turned quite on to the sound side there is da
not only from hampering the breathing but also in some
from escape of pus into the main bronchus of the soun
with consequent drowning.

The modern operation of **removal of the breast for cancer** is often associated with considerable shock, owing to its great extent and the amount of blood that may be lost. It is good, therefore, to employ ether for, at any rate, the first twenty minutes. Afterwards there is advantage in using chloroform, inasmuch as hæmorrhage is less and the risk of subsequent lung trouble is diminished. At the same time very careful watching is necessary lest the shock under chloroform grows too severe. This is best avoided by using the chloroform very sparingly, aiming at preserving a fairly brisk corneal reflex throughout, or by keeping the head at least as low as the level of the chest, *i.e.*, have no pillow, and if necessary lower the head end of the table. The tight bandaging of the chest necessary after these operations makes coughing difficult, and thus it is that if, by prolonged use of ether, much mucous secretion is present in the bronchi this is not easily got rid of, and may lead to bronchitis or even pneumonia.

Abdominal operations often offer special difficulty to the anæsthetist in connection with muscular relaxation. When the peritoneum is pulled upon, when there are manipulations in the neighbourhood of the diaphragm, when there is forcible pulling upon pelvic organs, in these and in other circumstances during operations within the abdomen, there is a great tendency for forcible contraction of the recti to take place, and in some cases this greatly enhances the surgeon's difficulties. Generally speaking, for long abdominal cases the best anæsthetic is open ether preceded by hypodermic injection of morphia and atropine. The induction may be effected by C.E., and this anæsthetic is to be chosen if there is special risk of subsequent lung trouble. When chloroform has to be used, it is a great advantage if the Trendelenburg position can be employed throughout. Shock is best combated by the use of ether or by continuous saline infusion, for which the simple apparatus of Arbuthnot Lane should be employed. The infusion should be started as soon as the patient is anæsthetised, and at least 2 pints of normal saline may be introduced in the course of an hour. A perfectly unobstructed airway and [illegible] are essential to the preservation of muscular [illegible]. The use of tongue forceps is rarely demanded, but [illegible] of a small prop for the lower jaw is almost [illegible] to the proper conduct of these cases [illegible] be used in a severe abdominal [illegible] with it throughout. The tube fr[illegible] over the metal stem of the [illegible] and oxygen provided in this way, the chloroform being supplied on to the mask from a drop bottle.

In cases of **intestinal obstruction** where there is risk of vomiting occurring during operation no closed apparatus is to be employed, for such vomiting takes place very quietly and might be unobserved if the face were covered. One shoulder is to be well raised on a pillow and the patient's head, with the mouth slightly opened by prop or gag, is to be turned towards the other side and slightly below the level of his chest. In this way risk of inhalation of liquid vomit is obviated.

Operations upon the rectum and upon the **genito-urinary passages** require deep anæsthesia, and generally ether is the best agent to employ. Straining and reflex movements of the legs during stretching of the anal sphincter are avoided if a deep anæsthesia without any cyanosis is provided. Similarly operations upon the fingers and toes require deep anæsthesia for the avoidance of reflex movements, which are easily set up from these sensitive parts with their free supply of nerve endings.

A special word may be said concerning the operation of **circumcision** in infants and young children, for many lives have been sacrificed through the idea that chloroform alone was suitable to these subjects. As a matter of fact this agent is to be avoided in these cases for this reason, that perfect stillness of the child when the prepuce is cut can only be got by very deep anæsthesia. If chloroform is used this depth of anæsthesia should not be reached, and for stillness reliance should be placed upon the control of the thighs by nurse or assistant. The best plan for these cases is to start with a few drops of chloroform during the initial crying, then to use C.E. till anæsthesia is achieved, and then to use only ether upon the open mask while the incision is made and during the rest of the operation. It is important that anæsthesia should be quite light before the stitches are put in or before the end of the operation if they are not used, because in this way only can the risk of later hæmorrhage be averted. An infant who is still deeply under the anæsthetic will not bleed from little vessels that later on, when recovery begins, may bleed in a way to cause considerable trouble, if not danger or actual death, as has occurred thus after this simple little operation. For safety's sake an infant should be in the wriggling stage before the dressing of the wound is completed at a circumcision operation.

For the **breaking down of adhesions in joints** it is generally best to use ether anæsthesia, for although the operation can often be done under nitrous oxide or ethyl chloride, yet the immediate recovery that ensues after these inhalations is apt to be followed by severe pain at the seat of manipulation, which is less noticeable after the more protracted recovery from ether.

For **the reduction of dislocations**, too, gas cannot be relied upon to provide the necessary relaxation, and here again ether is generally the best anæsthetic to use.

DIFFICULTIES AND DANGERS ARISING DURING ANÆSTHESIA.

This falls largely to the anæsthetist, and as he is in the best position for their early detection he should therefore hold himself responsible for a constant knowledge of the patient's condition and for advising the surgeon when any interruption or cessation of an operation is necessary. It is true that such conditions are usually complex and are partly due to the surgical procedure and only partly to the anæsthetic. For the treatment of shock itself the reader is referred to the article on that subject, but something must now be said of the proper steps to be taken when, as commonly happens, the anæsthetic is largely concerned in the production of a condition which requires remedying. Such conditions are most commonly seen during the inhalation of chloroform. Paleness of the face, which is accompanied by feeble breathing or feeble pulse, is generally the first indication of danger. It is associated with absence of the corneal reflex and a dilating pupil. The first step to be taken is to *lower the head*. If a pillow is being used, for instance, withdraw this, then briskly rub the face and lips with a towel. In most cases the breathing will now be more vigorous, the colour will return to the face, and no further steps are necessary than that for a time ether is to be used upon the mask in place of chloroform. In graver cases, in which breathing actually stops, first lower the head below the level of the trunk and then open the mouth with a gag and draw out the tongue with tongue forceps. If breathing is not at once resumed, put a hand on each side of the chest, and, using your weight, forcibly compress the ribs. The tongue forceps and gag must be handed to the surgeon if there is no nurse or assistant who can take charge of them whilst the anæsthetist devotes himself entirely to the all-important function of performing artificial respiration. If, after compressing the chest four times, at intervals of a few seconds, there is no spontaneous breathing, then artificial respiration by Sylvester's method is to be started. The movements are not to be carried out hurriedly, and after each expiratory phase there should be a moment's wait to see if a spontaneous breath is drawn. As soon as this occurs the artificial respiration is desisted from, but the spontaneous expirations are aided by compressions of the chest until good vigorous breathing is re-established. If there are several helpers available, the additional steps that may be taken comprise administration of oxygen while the artificial respiration goes on, and intravenous infusion of pituitary extract, or, if that is not available, of hemisine. But it is of the utmost importance to realise that the essential steps are not to delay the performance of artificial respiration, while the head is kept low and the airway clear.

The injection of strychnine is of value in cases only where there is primary cardiac failure. In the most usual class of case, where there is a gradual failure of respiration and pulse, to give an injection first is wasting valuable time which should be at once given to the establishing of proper breathing. Moreover, this establishment of respiration is itself the best possible means of strengthening the heart's action.

When ether is being used conditions of danger due to the anæsthetic only arise if there is an asphyxial element present. Therefore the onset of a serious condition is always associated with an amount of cyanosis which should attract the anæsthetist's attention and lead him to withdraw his anæsthetic, to make quite sure by opening the mouth moderately and drawing forward the tongue and swabbing out the pharynx, that there is no obstruction in the upper air passages, and to administer oxygen if a normal colour is not quickly restored. Reflex cessation of breathing and even of the pulse are sometimes seen at the first incision, as they are more commonly during dragging manipulations of deeply seated or sensitive parts. It is only rarely, however, that effects of this kind do not pass off very rapidly. Only the milder measures of lip rubbing and head lowering are generally required, and it is in these cases too, that an injection of strychnine is beneficial. When such reflex effects are produced during deep chloroform anæsthesia the most dangerous state may be rapidly entered upon, and, broadly speaking, it may be said that the lighter the anæsthesia, provided that consciousness and voluntary movement are completely abolished, the less is the risk in the course of long operations. In fact, in this matter it is most certain that prevention is better than cure, and that he who pays the closest attention to his administration and keeps most carefully within safe limits of dosage is he who is least often called upon to treat untoward conditions.

THE TREATMENT OF AFTER-EFFECTS.

The same judgment applies forcibly to the occurrence of after-effects requiring treatment. These follow the skilled much less than the indifferent administrations.

Sickness requiring treatment is rare after ether, though a small amount of vomiting, often before return of consciousness, is the rule after an administration of twenty minutes or more. After chloroform prolonged sickness occasionally occurs and is possibly a milder form of the rare severe cases described under the name of delayed chloroform poisoning. In these cases, of which the subjects are usually children, an apparently normal recovery of consciousness is followed in a few hours by repeated vomiting, by delirium, coma and death within two or three days. Acetone is present in the breath and the urine; on post-mortem a peculiar condition of the liver is found. The treatment when vomiting continues after recovery of consciousness is free administration of sodium bicarbonate in water, a solution of 1 drachm to the pint being offered for the patient's consumption and he being encouraged to drink as much of it as he will. If the vomiting still continues the stomach is to be washed out and some of the bicarbonate solution left in. Nothing else is to be given except glucose (70 per cent. solution), which is to be administered per rectum. In some nervous subjects the vomiting is of a different nature and is best avoided by the administration before the return of consciousness of an enema containing pot. brom. (3 drachms) in a few ounces of saline. Generally speaking, vomiting is best prevented by absolute stillness of the patient for at least six hours, by starvation during that period, by warmth and by restricting the intake to thin fluids during the next twenty-four hours.

Posture Paralyses due to pressure upon nerves may follow an administration in which a faulty position has been allowed. The arms hanging over against the edge of the table or too far stretched up beyond the head in a breast case, or a lithotomy position too violently secured, are examples of these faults. Treatment lies of course in proper prevention. The paralyses are recovered from, but may last a considerable number of days or weeks.

INTRAVENOUS ANÆSTHESIA.

The method of obtaining and maintaining anæsthesia by introducing an anæsthetic solution into a vein has recently been practised, and promises to be of great value in certain cases. The solution to be used is 5 per cent. of pure ether in normal saline.

It is prepared by gently shaking together, in a sterilised glass vessel, pure ether with sterilised normal saline, in the proportions of one ounce to one pint. Several pints should be prepared. The apparatus used must allow of continuous, but very slow flow of the solution into a tube leading into the cannula, which is inserted into the median basilic vein. The apparatus designed by Dr. Felix Rood answers all requirements. There must be no possibility of air bubbles passing into the vein, and the solution should be kept at a uniform temperature, about equal to that of the blood. It is advisable to fasten the arm to a straight splint in case there should be muscular excitement during the induction period. This lasts on the average about ten minutes, during which time nearly a pint of the solution is used. When anæsthesia is reached, it is kept up usually by the running in of about one pint an hour. For exposing the vein and inserting the cannula hypodermic injections of eucaine (5 per cent. solution) or novocaine (2 per cent.) may be used. In difficult subjects it is well to precede the infusion by an injection of morphia and atropine or scopolamine one hour previously. Though not yet extensively tried, the method appears to have special advantages in formidable operations about the face and neck and in long abdominal sections when the infusion of saline is of itself desirable.

SPINAL ANALGESIA.

When there is much objection on the part of a patient to loss of consciousness, or when his condition is very unfavourable for general anæsthetics, as *e.g.*, in diabetic gangrene, emphysema and bronchitis with failing heart and similar conditions, then spinal analgesia may well be employed if operation is imperative. The method has advantages also in cases of severe shock, and in acute abdominal sepsis in children. In the former the complete obstruction of peripheral impulses, and in the latter the avoidance of very probable and highly dangerous after-effects are valuable gains achieved by intrathecal anæsthetic injections. The complete flaccidity of muscles which it produces makes this method very acceptable to the surgeon during abdominal operations, and particularly perhaps in prostatectomy and excision of the rectum. It must not be overlooked, however that in a fairly large percentage of cases this flaccidity is interrupted by a period of retching or vomiting, lasting, it is true, for a short time only, but often very vigorous while it lasts.

The method is not to be recommended for the very nervous, and is inapplicable in cases of spinal deformity. Some authorities declare against it when there is any infection present in the patient, such as tubercolosis, syphilis or any form of generalised sepsis. It is not to be recommended generally for operations above the level of the umbilicus.

The most generally used agent is stovaine, of which the dose for an adult is 5 cg.: Barker's solution, 2½ per cent. stovaine, and 2½ per cent. glucose in water has been widely and successfully employed. For making the injection the patient should either sit with the back arched and the head bent low, or lie upon his right side, the thighs well flexed and the head and shoulders raised on a pillow. The line between the highest points of the iliac crests gives the level of the fourth lumbar spine, and the injection is to be made between first and second, or third and fourth lumbar spines. It must be made at a higher level if anæsthesia above the umbilicus is wanted, and the higher the anæsthesia required, the larger is the necessary dose. The site for puncture is chosen by putting the left forefinger between the two spinous processes at the level selected, and then entering the needle so that it just touches the pulp of the finger and is directed upwards and inwards. As it is pushed in it is felt to pierce the ligamentum subflavum and then the dura mater. It is inserted for a distance varying from 2 to 4 inches according to the thickness of the superficial coverings of the back. If no cerebro-spinal fluid flows the direction of the needle must be slightlyaltered, or it must be withdrawn and a fresh puncture made.

When cerebro-spinal fluid appears, the dose of stovaine solution is to be gently injected, the needle withdrawn and the puncture closed with gauze and collodion. The patient is then laid upon his back with the head and shoulders slightly raised. After about ten to twenty minutes anæsthesia of the lower limbs and lower portion of the trunk should be complete, as may be ascertained by testing with pinpricks. A screen is placed before the patient's eyes and operation proceeded with. Anæsthesia lasts as a rule for an hour. The proceeding is to be conducted with antiseptic precautions as complete as those employed for the operation itself. The patient should be prepared as though for a general anæsthetic, for in a small proportion of cases even in the most experienced hands this becomes necessary. Novocaine and tropococaine are by some authorities preferred to stovaine. After operation the greatest gentleness is to be used in moving the patient, and he should be kept as absolutely still as possible for the following twenty-four hours.

The needle used should be 4 inches long, and the point not very obliquely bevelled. It must be accurately fitted with a stylet. The syringe should be of glass and metal with easily detachable parts.

LOCAL ANALGESIA.

Local analgesia is obtained in the case of the eye by instillation; in the case of mucous surfaces by painting over them; in the case of the skin by subcutaneous injection; and in deeper situations by infiltration or by injection into the neighbourhood of nerve trunks (regional anæsthesia). In the case of the eye and of mucous surfaces cocaine is widely used; in the former case a solution of 4, and in the latter of 10 per cent., being commonly employed.

For hypodermic, and still more for infiltration injections, cocaine is too dangerous, though some prefer it, in very weak solutions (1 per cent.), to other drugs. Three grains should be the maximum amount allowed in this way. Eucaine (1 to 2 gr. in ½ per cent. solution), stovaine and tropococaine may be employed for infiltration or injection near nerve trunks. The first is commonly combined with adrenalin.

When infiltration analgesia is to be employed, the skin is pinched up and the needle inserted into the dermis. As the needle is further pushed along the solution is injected, and the process repeated until a white wheal is raised along the length of the prepared incision, and deeper parts are similarly injected as they are exposed.

Schleich's solution for infiltration consists of — Cocaine, 0·2 gramme; Hydrochlorate of Morphia, 0·025 gramme; Sodium Chloride, 0·2 gramme; Distilled Water, 100 c.c.

Care and precision are necessary with this method in order to inject only along the lines of incision and to cut only where injection has been effectual. The tissues are rendered œdematous, which is apt to be disconcerting to the inexperienced. Antiseptic care is of course to be strictly observed, the needle and syringe being boiled and the part to be operated on rendered thoroughly aseptic. The operations most fitted for local analgesia are those in which the field of operation is limited and superficial, and in which its limits can be outlined with certainty before the operation is begun. Thus tracheotomy in the adult, which is often required under conditions of special danger for inhalation anæsthesia, should generally be performed with local analgesia. Regional anæsthesia has been much employed for small amputations and even for major amputations in the upper extremity where the chief nerves are superficial at certain points and can be well rendered anæsthetic by injections.

The solution most used, perhaps, has been Oberst's—Cocaine, gr. ·1; Adrenalin, ♏8; Saline solution, ʒiv.

Some minutes must be allowed after injection for the solution to take effect. The anæsthetic effect is heightened by constricting the limb along the injection sites, the constriction being removed before the operation begins.

J. BLUMFELD.

BIER'S TREATMENT BY MEANS OF INDUCED HYPERÆMIA.

It is by no means an easy task to write an article on the subject of Professor Bier's hyperæmic treatment. It will be my endeavour to avoid, so far as possible, all theoretical discussions, any attempt, which might prove futile, to reconcile the theory of the method with ascertained facts of modern physiology and pathology, and any explanation of the good results which are undoubtedly obtained by this novel therapeutic agency. Fortunately this article is written for a System of *Treatment*. It will, therefore, suffice if I confine myself entirely to the question of treatment, and omit, of set purpose, any reference to the physiology of the method. It is the more justifiable for me to adopt this course, as I am able to refer any inquirer as to the "why and wherefore" to the work of the originator of the method, *i.e.*, to Bier's "Text-book of Hyperæmia as Applied in Medicine and Surgery," translated by Dr. G. M. Bleck (Rebman, Ltd.). In this book Professor Bier attempts, with more or less success, and I will quarrel with no physiologist who asserts with less rather than more, to explain the physiological aspects of his treatment, and to bring them into conformity with modern physiological teaching. This work will afford any information concerning the theory of the subject that the originator of the treatment can offer; and to it I would refer any of my readers who may wish for authoritative guidance at first hand. For the English reader who may desire to further pursue this fascinating subject, with a minimum expenditure of time and a maximum of profit, I would strongly urge that he read the excellent work of Dr. Willy Meyer and Professor V. Schmieden, entitled "Bier's Hyperæmic Treatment" (W. B. Saunders & Co.). To the two above-mentioned books I desire to acknowledge my indebtedness for much valuable information, of which I have not hesitated to avail myself in the compilation of this article. In Meyer and Schmieden's book will be found references to the literature of the subject so complete that I feel myself absolved from the necessity of doing more than refer my readers to this work for any information that they may desire concerning the opinions of the numerous writers on the subject of the hyperæmic treatment. At the risk of repetition I desire cordially to recommend this work of Meyer and Schmieden to my readers. I may, perhaps, be permitted to refer any reader desirous of obtaining brief details of twenty illustrative cases in which Bier's treatment was employed to an address delivered by me to the South Midland Branch of the British Medical Association, and published in the British Medical Journal of July 18th, 1908.

The publication of Professor Bier's "Hyperämie als Heilmittel" was a veritable bomb-shell thrown, I fancy, with studied deliberation, into the surgical camp. Nothing more iconoclastic nor more entirely at variance with the accepted teaching of the processes of inflammation could possibly be conceived! To deliberately desire to increase the congestion already existing in an inflamed part appeared, at first thought, to be an act of madness. Small wonder, therefore, that Professor Bier's earlier communications were received by the surgical world with scornful derision. In their teaching they ran counter to the commonly accepted axioms of surgery. It was no easy matter to put Professor Bier's propositions to the test of therapeutic enquiry. Should, as seemed inevitable, disaster follow any such experimental test, the surgeon would feel himself culpable in having risked the life or limb of his patient in carrying out a hopelessly unscientific method of treatment which could only be foredoomed to failure. For the moment Professor Bier stood alone to face the storm of ridicule and abuse. Soon, however, there gathered around the master a small but faithful band of followers, who recognised that in him were found in combination a physiologist, a physicist, and a profound surgeon. Clinical investigation proved that in the hyperæmic treatment there existed potentialities of therapeusis hitherto undreamed of. Results were obtained, especially in tuberculous and pyogenic joint affections, surpassing any granted by other methods of treatment. The ever-increasing testimony to the success of the method slowly, but surely, wore down opposition, and at the present moment Bier's hyperæmic treatment may be said to occupy a recognised place in surgical therapeutics.

The battle, however, is far from won. The method is still, even by high authority, not infrequently proclaimed dangerous or unscientific, and it is a matter of deep regret to me that in no country of leading scientific importance has the method received less recognition than in Great Britain. I have no hesitation in stating my opinion that in Germany, France, and the United States of America Bier's hyperæmic treatment is employed ten times for every one occasion of its use in this country.

I speak from experience when I state that it is the exception to meet with a practitioner who has any real knowledge of the treatment, and that even in the highest surgical examinations it is by no means infrequent to meet with candidates who admit that they have never seen the treatment applied. As one of the earliest and most strenuous supporters of Bier's treatment in this country, I may be allowed to express my satisfaction that the method is steadily gaining ground, and my conviction that, given a fair trial, it will prove one of the greatest surgical discoveries of the nineteenth century. No reasonable surgeon would venture to place it alongside of the discovery of anæsthesia or of antisepsis, but next to these two I regard Bier's treatment as worthy to occupy, though admittedly at a great distance, a high place of merit.

It may be stated that the aim and object of Bier's treatment is to increase the volume of blood circulating in a diseased or damaged part of the patient, in the firm belief that the hyperæmia will aid the tissues in their effort to overcome the disease or to repair the damage. I desire most emphatically to emphasise the word *circulating*. It is absolutely essential that the blood continues to circulate in the damaged area. Stasis of the blood current is entirely opposed to Bier's ideas, and is fraught with grave danger to the vitality of the affected part. It is the thing of all things that must be most carefully avoided. I have employed Bier's treatment with ever-increasing confidence and satisfaction for the past fifteen years, and have now used it in a very large number of cases. In the beginning I confess that I employed it with fear and trembling. It seemed to me to be so unwise to endeavour purposely to increase the congestion in an already inflamed part, and I had constantly before my mind the fear of causing gangrene of the limb, distal to the constricting elastic bandage. I may here remark that my first trials were made with the elastic bandage, and that this method has yielded me the most satisfactory results that I have obtained from the treatment. The novice in the employment of the constricting bandage will make one of two mistakes. Either he will apply it too firmly or too loosely. In the latter case no harm will result, in the former pain will soon indicate the error, and will call for the re-application of the bandage, otherwise stasis of the blood current or even gangrene may result.

Pain means that Bier's treatment has been wrongly employed. In the correct employment of the hyperæmic treatment no pain should be caused, and if pain is present in the part prior to the application of the treatment, this should soon be mitigated. It must be regarded as a cardinal rule, therefore, that the hyperæmic treatment must be *painless*.

The two chief rules regarding Bier's treatment may be thus stated:

(1) That the blood must continue to circulate in the diseased part.

(2) That the treatment must be entirely painless.

Not only should the patient not dread the renewed application of the hyperæmic treatment, but he should look forward to it with satisfaction.

I would add that the cases in which Bier's treatment may be expected to yield the most satisfactory results are those in which the contest between invading micro-organisms and the tissues of the body is a fairly evenly balanced struggle. In such cases,' *e.g.*, early tuberculosis of a joint in a child, Bier's treatment may generally be trusted to turn the scale in favour of the tissues, and is far more likely to prove successful than in instances in which the microbic invasion is of virulent potency, and in which the reaction of the tissues is weak or almost *nil*. Bier's treatment aids greatly tissues which are able to protect themselves. It is no general panacea, and in overwhelming toxic invasions is of little avail.

Of the five cardinal symptoms of inflammation, heat, redness, swelling, pain and impaired function, Bier and his followers intentionally seek to increase the three former, viz., heat, redness and swelling, in their confidence that, in the vast majority of cases, there will result a sensible diminution of the two latter, viz., pain and impaired function.

I desire now to briefly describe in what, to my understanding, Bier's treatment consists. I, in common with those surgeons who follow Bier's teaching, regard inflammation as a purposive attempt of nature to free the tissues from the noxious microbes that have invaded any part of the body. Inflammation is thus regarded as nature's method of eliminating the attacking microbes. Bier's treatment has, as its object, the artificial stimulation of this eliminating function by causing a hyperæmia (venous or arterial), and thus making use, to the utmost available extent, of the antimicrobic action of the blood. Surely the more minutely we study the methods of nature in endeavouring to remove the microbes that attack the tissues of the body, the more we will understand how Bier's treatment is the adjuvant and helpful co-worker, and not the senseless antagonist as maintained by the opponents of the method.

Our forefathers regarded inflammation as an essentially harmful process, which called for their best efforts, directed against its suppression. Hence the anti-phlogistic treatment. We, under the guidance of Bier, regard it, on the contrary, as an essentially beneficent and well-ordered influence of protection, whose tendency is towards repair, and, as such, demanding our help and guidance, rather than deserving our attempts to abort its rational and useful intentions. The above is, I know from experience, a matter upon which it is difficult to obtain general agreement.

I would venture to ask those who dissent from Bier's view to consider two cases of perforative appendicitis. In A there are all the signs of sthenic inflammation: temperature 103, full bounding pulse of 130, and rigidity of abdominal wall. In B the condition is one of intense depression of vitality: the temperature is subnormal, say 97, the pulse feeble and only felt with difficulty, even though its rate is the same as in the former case (A), the abdominal wall is retracted and flaccid. What surgeon could doubt that the prognosis is better, by far, in A than in B (after operative treatment)? In A there is obvious inflammation, and nature is making a real fight against the invading organisms, a fight which, aided by surgical treatment and free drainage, may end in the recovery of the patient. In B there is no inflammatory reaction. The peritoneum is overwhelmed by the potency of the microbic attack (probably streptococcal), and death from acute septicæmia will occur within a short time. Yet in case A inflammation and its effects are very marked; in case B, owing to the fact that the virulence of the microbic attack completely overwhelms the defensive forces of the tissues, inflammation is conspicuous by its absence. How, therefore, can it still be maintained that inflammation is an essentially harmful process?

Surely, therefore, the day of febrifuges, ice-bags and such measures, destined to check or to suppress inflammation, is already past, and the time is assuredly coming when the profession will view the processes of inflammation as useful and protective rather than as noxious and destructive!

The hyperæmic treatment existed long before Bier's time, though I admit that it was but ill-understood. For centuries counter-irritants, hot fomentations and hot poultices were employed in the treatment of inflammation. Is it not a fact that these measures produce hyperæmia, and that the undoubted service that they render is, in many instances, due, in large degree, to the hyperæmia they occasion?

Many opponents of Bier's treatment make use of the above measures, quite regardless of the fact that their efficiency depends, in large part at least, upon the hyperæmia to which they give rise.

In carrying out Bier's treatment we endeavour to cause a hyperæmia of the diseased part in chronic conditions, and to increase an already existing hyperæmia in acute inflammations. We do this in the firm and reasoned belief that an increase in the amount of blood circulating in the diseased area will prove, owing to the anti-microbic quality of the blood, a useful and potent help to the tissues in their contest with the invading bacteria.

The Aims of Bier's Hyperæmic Treatment.—These may be stated thus:

(1) The arrest or, at least, the mitigation of the infection.

(2) The prevention of suppuration in many cases in which this is threatening.

(3) The relief or the mitigation of pain.

(4) The avoidance of operative treatment in many cases, or, where this is not possible, the substitution of a less severe and less mutilating operation than would otherwise be necessary.

(5) The saving of time, owing to the effect of the treatment in hastening the eliminating process, in cases in which suppuration and necrosis are unavoidable, *e.g.*, in carbuncles in their later stages.

(6) The increase in the anti-microbic action of the blood, due chiefly to the greater volume of blood circulating in the affected part.

(7) The stimulation of the processes of repair, as evidenced by the success attending the method in instances of delayed union of fractures, and in the treatment of many chronic ulcers, *e.g.*, of the leg.

No adherent of Professor Bier's doctrine would be so unwise as to contend that by means of the hyperæmic treatment suppuration can always be prevented. All that is claimed is that the method offers a greater chance of avoiding suppuration than any other known to science.

METHODS OF APPLICATION.

(1) **Constriction**, by using an elastic bandage.

(2) **Suction**, by making use of cupping glasses.

(3) **Heated Air.**

Constriction produces a hyperæmia which is purely passive, *i.e.*, venous: suction, one which is also essentially passive, though, I imagine, at the commencement active or arterial. Heated Air, on the other hand, gives rise to an active, *i.e.*, arterial, hyperæmia. Were a surgeon to be asked his opinion as to the beneficial results likely to follow from the three above methods of treatment he would certainly, had he no experience of the hyperæmic treatment, imagine that the maximum of benefit would follow the employment of arterial hyperæmia. In practice, however, I am confident that it will be found that passive hyperæmia will be employed far more frequently than the active (arterial) method.

In my own experience I have employed passive (venous) far more extensively than active (arterial) hyperæmia, and I have obtained more satisfactory results from the former than from the latter. The reason of the more frequent employment of the former method is not far to seek. Passive hyperæmia requires only a cheap apparatus (elastic bandage or suction glass), is readily managed by the patient, and therefore deservedly has an extended field of usefulness. Active hyperæmia demands apparatus which is more costly, its application calls for more supervision, its improper employment is attended with serious danger (burns are by no means infrequent), and it calls for greater intelligence on the part of the patient.

Passive Hyperæmia Induced by Elastic Constriction.—This represents Professor Bier's original method of treatment, and still remains the best, as judged by results. All that is required is a gentle constriction in order to cause a slight obstruction to the return of the venous blood from the affected limb. No such amount of constriction as would even diminish the volume of arterial blood brought to the limb is permissible. We have, therefore, to graduate carefully the pressure of the constricting bandage, and to employ the bandage only just so tightly as to obstruct moderately the venous return from the limb, without in the slightest degree diminishing the supply of arterial blood to the part. Such a measure of accuracy may appear to the novice a matter of real difficulty, and he will, in all probability, commit one of two mistakes, viz., he will apply the bandage so loosely that no hyperæmia is caused, or he will make too firm constriction, with the result that the arterial supply to the limb is sensibly diminished or even arrested! The latter is the more frequent error.

No such mistake will be made by the expert. He will take care to apply the constricting bandage with just the amount of pressure required. He will make certain that, whilst a definite hyperæmia of the limb, distal to the bandage, is caused, the pulse in the part subjected to treatment can be felt to beat, and that no pain is complained of by the patient. Though I have applied the bandage hundreds of times, I never place reliance on my muscular sense: I trust entirely to the patient's sensations. If the constricting bandage occasions no pain, or if it mitigates an already existing pain, I am satisfied that the application of the bandage is correct. If the patient complains that pain is caused or an already existing pain aggravated, I know that the bandage requires to be slackened. When the constriction is correctly estimated, the part subject to treatment should assume a dark, congested, bluish colour which has in it just a suggestion of red.

Subcutaneous punctate hæmorrhages are indicative of an undue amount of constriction.

Theoretically it is possible for the bandage to be applied just too loosely, so as to constrict only the lymphatic vessels and not the veins. In this instance there would result an accumulation of lymph (lymph-œdema), and the part would assume a whitish appearance, instead of the blue-tinged-with-red colour which is desired. Such a condition I have only once seen. It calls for a slight tightening of the bandage, as flooding the part with blood, not with lymph alone, is the object of the hyperæmic treatment.

I always employ for the upper limb a Martin's bandage, 1½ to 2 inches in breadth, for the lower limb one 2 to 2½ inches. I roll it round the limb some eight to ten times and endeavour, by making each turn of the bandage ascend the limb about ½ inch higher than its predecessor, to subject to pressure a broad segment of the limb (at least 3 to 4 inches in the upper and 4 to 5 inches in the case of the lower limb). By this means the constriction is equably spread over a considerable area, and harmful local compression is avoided. I have never found it necessary to apply a flannel or lint bandage under the elastic constricting bandage, as I have never seen any untoward results at the site of constriction. Such can be avoided with certainty if the bandage is applied over a broad area, and on its removal the skin covering the site of constriction is sponged with methylated spirit. Even this precaution is only necessary after the first few applications of the bandage in persons whose skin is unduly sensitive.

In the case of affections of the upper limb of or below the elbow, the bandage is applied to the upper arm. For affections of the knee or parts of the lower limb below the knee the application is made in the lower part of the thigh. This rule must be rigidly followed even in inflammatory conditions involving the tip of a finger or of a toe. If the bandage is applied below the elbow or the knee, the more deeply placed inter-osseous veins may readily escape constriction, and the venous return through these vessels may nullify our efforts.

The elastic bandage is chiefly employed in affections of the upper and lower limbs. It may, however, be used with success in affections of the head and neck, and also in scrotal, penile and testicular maladies.

In all the above cases the elastic constriction is applied between the affected part and the heart, that is, proximally to the seat of the affection. Unfortunately, the above-mentioned comprise all the regions that are amenable to the elastic-bandage constriction. It cannot be employed for the trunk. I have failed to apply the method in the case of the hip-joint, and have only met with moderate success in the treatment of affections of the shoulder-joint, where I have applied the bandage so as to cover the middle-third of the clavicle and to lie over a firm pad placed in the axilla. In situations other than the limbs a much narrower bandage is employed. Ordinary garter elastic fulfils all requirements. Very striking is the difference in the appearance of the limb when the constriction is applied (1) for an acute inflammatory condition, *e.g.*, a whitlow; and (2) in a chronic condition, *e.g.*, an early case of tuberculous arthritis of the wrist-joint.

(1) In acute cases marked hyperæmia soon follows the application of the constriction, with rapid increase of heat, swelling and redness, which may extend up to the seat of constriction. The sudden onset of this rapid extension of redness, heat and swelling may cause great alarm to the inexperienced, but may be regarded as quite normal.

(2) In chronic cases the increase in the redness and heat of the part may not be manifest. In this case it is well to sponge, or better to immerse, the part in hot water prior to the application of the bandage. This will usually have the desired effect.

It is, of course, obvious that the elastic constriction, while it produces the desired hyperæmia, causes also œdema of the part, and that the more prolonged the constriction the more marked the œdema that will be occasioned. In almost every instance elevation of the œdematous limb, combined if necessary in chronic (not in acute) cases with gentle massage, will, after removal of the bandage, rapidly and satisfactorily reduce the undesirable œdema.

I find that even after extensive experience I am unable to lay down definite rules as to the length of time that the constricting bandage should be applied daily, and as to the duration of the intervals that should be allowed between consecutive applications of the hyperæmia-producing elastic bandage. Increasing experience serves only to confirm the opinion I expressed in my first contribution to the subject that "each case is a law unto itself." No dogmatism is possible.

In the treatment of chronic cases I always endeavour to keep the bandage applied for six hours, and to allow three hours to elapse after its removal before I re-apply it. Stated briefly in chronic cases I aim at six hours "on" and three hours "off." As the patient becomes accustomed to the treatment I find that I can, in general, gradually extend the time when the bandage is "on," and diminish the "off" interval. Thus I am frequently able to direct that during the day the bandage be applied for eight hours and removed for two hours, and that at night it be employed during the whole period of sleep. I have, under certain circumstances, kept the bandage applied for twenty-two hours consecutively out of the twenty-four; but I consider that the disadvantages of this plan, especially with regard to the persistent œdema liable to be produced, outweigh its advantages.

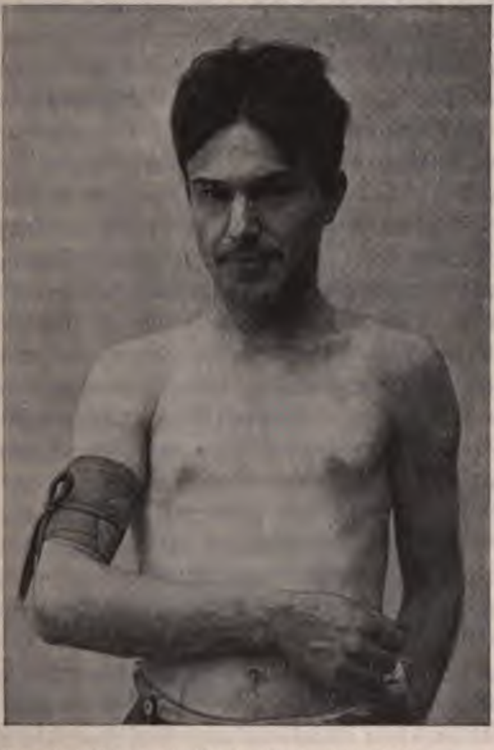

FIG. 1.—Shows elastic bandage around the arm. Note engorgement of subcutaneous veins. (Willy Meyer & Schmieden.)

In the case of young children, certainly at the commencement of

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the treatment, *i.e.*, until the part become accustomed to the alteration in the circulation, I find that it is wise to adhere rigidly to the rule of three hours " on " and three hours " off."

A very limited experience of the treatment of acute inflammatory conditions will soon teach the surgeon that in a considerable proportion of cases so long-continued an application of the bandage cannot be borne, and if persevered with will result in harm, and the same may be said even in not a few chronic diseased conditions. If I am asked " What, then, is to be the guide as to the length of the period of application of the bandage? " I can only say, at the risk of reiteration, " Be guided by the sensations of the patient."

In case of doubt the prudent surgeon will, of course, prefer to *under-do* rather than to *over-do* the treatment.

In many cases when the inflammatory condition first comes under treatment suppuration will already be present. In such the line of treatment is absolutely clear and definite. Here, as in every case, *the pus must be evacuated.* Enthusiastic supporter as I am of Bier's treatment, I know that it, valuable as it undoubtedly is in warding off suppuration in cases where suppuration is threatened, is powerless to promote the absorption of pus already formed.

I go further and freely admit that Bier's treatment, applied in a case in which pus is present, is, unless steps are taken to secure its evacuation, far more likely to do harm and to increase pain than to act beneficially and to alleviate pain. Even, however, in cases in which suppuration has already occurred, Bier's treatment, properly employed, is an agent of real benefit. Here an incision must be made to give vent to the pus, but it need only be a small puncture instead of a free incision.

It is noteworthy that even after a tiny incision the part subjected to Bier's treatment recovers, when recovery is still possible, far more quickly than when incisions, large and free, are made without the assistance of the hyperæmic treatment.

During the first few hours following a small incision into the suppurating area and the employment of the elastic-constricting bandage the discharge of blood and pus from the incision is unusually free, but soon the discharge lessens and the damaged part, unless it is beyond recovery, quickly assumes a more satisfactory appearance.

Bier's treatment has a further advantage. In a large number of cases even the experienced surgeon is unable to satisfy himself whether or no pus has already formed, and may therefore hesitate whether to make an incision or to wait awhile. Such a case presented itself to me late one evening. It concerned the right index finger of a musician. My opinion was sought because of a conflict of judgment on the part of the patient's two medical advisers. One, an able young practitioner, maintained that if pus were not already present it would certainly be so by the morning, and that therefore the wise course was to make an incision, in the belief that if pus were not already present the relief of the tension and removal of pyogenic organisms and their toxins would be beneficial. To this sound surgical advice the patient and his brother, a medical man, were strongly opposed. They maintained strenuously that an incision on the palmar aspect of the index finger must leave a scar which might be a painful one, and would prove of detriment to the patient in following out his career as a musician. I had to decide the difficult question and felt the force of both arguments. I said that we would leave the decision to Bier's treatment. If pus were not present the hyperæmic treatment would relieve the pain and difficulty in flexion of the finger. If pus were present it would increase the pain. I therefore applied the constricting bandage, with the result that on every one of the five occasions I applied it I was forced to remove it before the expiration of five minutes owing to the intense aggravation of the pain complained of by the patient. Furthermore, the redness and swelling rapidly extended up the hand. This was an instance, and I have since seen many others, of *the diagnostic value of Bier's treatment.* I said to the patient and his brother, "While my diagnostic powers were unable to satisfy me that pus was present, the aggravation of the pain under the hyperæmic treatment has made me certain of its presence."

A tiny incision evacuated three drops of pus and rapid healing occurred, with preservation of a perfect digit under the employment of the hyperæmic treatment.

I have ventured to relate this experience in order to emphasise the importance of the hyperæmic treatment as a valuable diagnostic agent in cases of suppurative inflammation. In every case in which acute suppuration was present, and in many in which there was a chronic abscess, Bier's hyperæmic treatment has caused an aggravation of pain until vent was given to the pus by a small incision. Then, and only then, was the beneficial action of the treatment appreciated.

In no case of acute abscess in a part, such as an extremity, amenable to Bier's treatment is a large incision demanded. When a mere puncture-incision, just large enough to allow of the escape of the pus has been made, the employment of Bier's bandage will give rise to a discharge, always at first free and blood-stained, but rapidly diminishing in amount, and the alleviation of symptoms due to septic absorption will be attained with a minimum of expenditure of time and a maximum of safety. It cannot be too strongly emphasised that in suppurative cases exit must be given to the pus. No one maintains that the hyperæmic treatment can cause the absorption of pus already formed. All that can be stated, and this with the utmost confidence, is that once vent has been given to the pus Bier's hyperæmic treatment aids in a most satisfactory manner the tissues in their conflict with the infective micro-organisms, and is of more avail than any other method known to surgery in checking the spread of the infective process and in bringing about a restoration to the normal. The more I practise the hyperæmic treatment the more convinced am I, as I have previously stated, that the greatest benefits resulting from the treatment are found in those cases in which the conflict between the tissues and the invading micro-organisms is one that is a fairly balanced contest, but in which victory inclines to the side of the microbic invaders. In such cases the hyperæmic treatment may generally be relied upon to turn the balance in favour of the tissues, and to thus change imminent defeat into victory.

It may be stated that there are three grades of virulence of microbic invasion, and in this respect due regard must be paid to the resisting power of the invaded tissues, strong and useful in the case of the healthy young adult, feeble and vitiated in the albuminuric and the diabetic patient:

(1) In which the virulence of the microbes is comparatively slight, and in which the tissues, unaided by Bier's treatment, may be relied upon to overcome the invaders.

(2) In which the virulence of the microbes is overwhelming, and the tissues, aided even by Bier's treatment, are powerless to ward off the advancing infection.

(3) In which the contest between the microbic invaders and the tissues is fairly even. This, in my opinion, is the largest group of the three, and the one in which Bier's treatment, judiciously applied, renders services unequalled by any other method of therapeusis.

I have employed Bier's elastic bandage extensively in cases of tuberculous disease of the elbow, wrist, bones and joints of the hand and foot, ankle and knee joints. The results I have obtained have far surpassed those I have observed under any other method of treatment. A large majority of the cases were in children under fourteen years of age, treated in the wards of the Victoria Hospital for Children, where the method was carried out under the immediate supervision of a most able ward-sister. I may here remark that the younger the patient affected with tuberculous disease of one of the above-mentioned parts, the better the prognosis as the result of Bier's treatment. I desire to admit freely that in the great majority of cases of tuberculous disease, Bier's treatment was used in conjunction with the injection of a sterilised 10 per cent. emulsion of iodoform in glycerine. It is impossible, therefore, to state with accuracy the proportion of credit due to each of the above therapeutic measures. Each in itself is of real value, and the two employed in combination certainly offer by far the best prospect of cure known to us in early tuberculous joint-disease.

It would be impossible to enumerate every case in which the hyperæmic treatment, by means of the elastic bandage, has been employed with, in my opinion, marked benefit to the patient. I may mention a few only of the most frequent:

(1) Whitlows of all varieties, in slight cases without, but in general after a small incision has been made into the inflamed part to evacuate pus or germ-laden inflammatory effusion.

(2) Suppurative arthritis of elbow, wrist, digital joints, knee, ankle, tarsal and phalangeal joints of the foot, in every case after the articulation has been punctured, or in severe cases more freely opened.

(3) Chilblains, in which the hyperæmic treatment acts as a charm.

(4) Septic conditions of all kinds of the upper and lower limbs, such as lymphangitis, cellulitis, furuncle, poisoned wounds, *e.g.*, post-mortem infections, bites of animals.

(5) Crushing injuries of hand and foot, *e.g.*, those sustained by the hand or forearm being caught in a printing-press, or the foot or leg run over by a motor-car.

(6) Osteomyelitis, especially of pyogenic, but also of tuberculous origin, involving the bones of the upper and lower extremities.

(7) Gonorrhœal arthritis, especially of the knee-joint in the male and wrist-joint in the case of the female.

(8) Teno-synovitis of pyogenic, tuberculous, traumatic or of gonorrhœal origin.

(9) Septic infections of scalp or of face, in the treatment of which a collar of garter elastic is placed around the neck.

(10) Tuberculous disease of cervical and parotid lymphatic glands, in which the same method of application is employed.

(11) Tuberculous and gonorrhœal disease of the epididymis, in which the constricting bandage surrounds the cord above the testicle.

(12) Lymphangitis of septic origin, chancroidal, herpetic, and

other forms of ulcëration affecting the penis and prepuce. In such cases the garter elastic is made to encircle the root of the penis.

I do not contend that the above list has any claim to be considered as an exhaustive list. The indications for the hyperæmic treatment given comprise merely those in which I have most frequently made use of the constricting bandage. I have advised its employment in a large number of other conditions. In my opinion I have little doubt that the surgeon who has carefully studied Professor Bier's treatment will share my opinion that it is *of real value in the large majority of affections of the upper and lower limbs* that come under his notice.

I have advisedly emphasised the upper and lower limbs for the reason that the results I have obtained in the case of the head and neck, testicle and penis have been in no degree comparable to those I have attained in the case of affections of the extremities. In the case of the head and neck I have, by the employment of the collar of garter elastic applied around the root of the neck, obtained in cases of infected wounds of the scalp and face, in boils and carbuncles, and in erysipelas, results that were in general satisfactory, and in some instances even brilliant.

In examples of tuberculous disease, *e.g.*, lupus of the face and cervical adenitis, the gain has in general been but slight, and the results frequently disappointing.

As regards the testicle and penis, especially in relation to affections of the epididymis, the benefit obtained has been decidedly less than in the case of the extremities, but certainly greater than in the case of affections of the head and neck.

Before I leave the constricting bandage, I would desire to repeat the warning that in cases of acute inflammation the cutaneous redness, heat, and swelling frequently rapidly extend several inches higher up the limb than was the case before the employment of the hyperæmia-producing, constricting bandage, and not infrequently reach up to the lower limit of the bandage itself. This state of affairs, always a source of anxiety to the patient, may alarm the surgeon, as it seems to the inexperienced observer to be indicative of serious aggravation and spread of the inflammatory process.

It need, however, occasion no alarm, and may be regarded as almost a normal result. I have frequently noticed that in those cases in which this phenomenon was observed the hyperæmic treatment was productive of the maximum of benefit in the minimum of time. In examples of chronic inflammation this rapid extension of redness and swelling is very rarely observed. In fact, in such it is, as a rule, difficult to obtain even a moderate degree of cutaneous redness. I would further once again insist that in cases in which suppuration has already occurred, an incision is always required. The hyperæmic treatment applied to suppurative affections without a preliminary incision can only do harm, and this the greater the more acute the suppurative process. I have above mentioned the fact that the increase of pain caused by the constricting bandage, otherwise properly applied, has a real diagnostic value as regards the presence of pus. If pus is present the hyperæmic treatment markedly aggravates the pain, which, on continuance of the treatment, soon becomes intolerable. In this instance, as already stated, the increase of pain in the affected part informs the surgeon that there is something amiss with the treatment. An incision, usually only a small one, is made into the pus-containing area; pus, perhaps only in a minute quantity, is evacuated. The constricting bandage is re-applied. No further complaint of pain is made; the discharge is at first copious and sanio-purulent, but soon diminishes, and at the same time the redness and œdema rapidly subside. The patient's sensations must always remain in the carrying out of Bier's treatment our most valuable and trustworthy guide.

I need hardly insist upon the importance of constant supervision during the first few hours following the application of the bandage, especially in cases of acute inflammation. In such it is wise, whenever possible, to recommend that a reliable nurse be in attendance. When this is not practicable, the surgeon may secure freedom from anxiety by instructing the patient or his friends to remove the bandage if at any time the pain in the affected part increase in severity.

I would draw special attention to the point that success depends upon the constriction exerted by the elastic bandage being regulated to a nicety. Some nurses are adepts in this respect, others can never learn how correctly to apply the bandage. On many occasions, in cases in which Bier's treatment produced no improvement, an immediate change for the better resulted from the substitution of a nurse efficient in the art of exactly regulating the degree of hyperæmia for one who did not possess this happy knack.

Whilst there can be no denying the statement that an unduly tight constriction might seriously endanger the vitality of the part, especially in the case of a finger affected with an acute inflammatory condition, *e.g.*, whitlow, and that thereby gangrene might be caused, I have no hesitation in regarding this as a theoretical rather than as a practical objection to the method, since, in an experience of hundreds of cases extending over several years, no instance of such a calamity has ever come under my observation, nor have I ever heard of one. The surgeon may therefore feel confident that, provided he is guided by the sensations of the patient, he need have no anxiety on this score.

One further point merits mention. In the case of the lower limb it has frequently happened that a lesion calling for Bier's treatment, *e.g.*, a chronic ulcer of the leg, has occurred in a patient the subject of varicose veins. In many such instances I have been asked if Bier's treatment can be justifiably employed on account of the risk of thrombosis supervening. I have invariably replied that the risk of thrombosis is *nil*. I have no knowledge of thrombosis having arisen in any such case, and I think I am correct in thinking that Professor Bier, with his vast experience, has never encountered such a result of the hyperæmic treated.

To sum up briefly the rules regarding the employment of the constricting bandage:

(1) Aim at producing venous congestion without arterial obstruction.

(2) Let the patient's sensations be your chief guide, bearing in mind that the hyperæmic treatment should relieve, not aggravate, pain, and that if increase of pain results, something is surely amiss with the treatment.

(3) Remember that in cases in which pus has already formed the hyperæmic treatment is incapable of causing its absorption, and is more likely to do harm than good. Bear in mind, further, that the increase of pain consequent on the judicious application of the bandage has a diagnostic value of real service.

(4) In cases of doubt under-do rather than over-do the treatment.

Hyperæmic Treatment by Means of Cupping Glasses (Suction-Apparatus, Partial Vacuum).—I have had considerable experience of this method of treatment, and have learned to estimate highly its value. In my opinion its chief merit is that it can be employed in the treatment of affections situated upon the trunk in which, for obvious reasons, the constricting bandage is inapplicable. The results that I have obtained by this, Bier's second method of treatment, have been in no degree comparable to those achieved by the constricting bandage in the case of the extremities. They have, however, been, on the whole, entirely satisfactory, and I have therefore confidence in recommending the suction treatment for many affections in which the curative effect of hyperæmia is desired, but in which it cannot be obtained by means of the elastic bandage owing to the anatomical location of the lesion. It cannot be denied that though the method is inferior to the constricting bandage in cases in which either is applicable, it possesses many merits, and that its range of application is extensive. It may be stated, as a general rule, that the more superficially situated the affection the more satisfactorily will it react to the suction treatment. It is quite true that the suction glass applied to the skin will cause a hyperæmia not only of the area of skin and subcutaneous tissue sucked into the interior of the glass, but also of the deeper structures. It is, however, obvious that the hyperæmia of the more superficially placed tissues will be greater than that of the more deeply lying layers, and therefore more curative in its results.

The suction treatment cannot be employed continuously. In this method of treatment only those layers superficial to the deep fascia, viz., the skin and superficial fascia, are, by means of a production of a partial vacuum, sucked into the interior of the glass vessel by means of the suction apparatus attached thereto. The suction-producing apparatus is, in the case of the smaller cupping glasses, of the nature of a rubber ball without valves. In such forms of suction apparatus as are constructed to meet the demand for a stronger vacuum a special suction pump is employed ; but of these I have had only a limited experience.

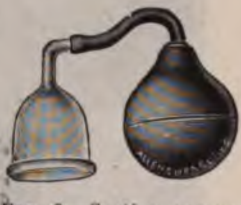

FIG. 2.—Suction apparatus for furuncle.

In all cases in which it is desired to produce hyperæmia by means of suction I smear the margin of the glass with some greasy substance in order to prevent the entrance of air between the skin and the glass.

In the employment of the treatment by means of the suction glass, Bier's rule must be carefully observed: "No pain must be caused by the treatment." If pain is caused, or, if already existing pain is not quickly mitigated, there is something essentially wrong with the method of treatment. It is *not* Bier's treatment, as this would diminish or abolish pain.

In any event it is wiser to under-do rather than to over-do the suction. The skin encircled by the cupping glass should assume a bluish-red colour. Should it be white the force of the suction must be immediately reduced, as this colour is indicative of anæmia or even of arrest of the circulation in the affected part, conditions that can only prove harmful, as our object is to induce a curative hyperæmia of the affected area.

In suppurative affections Bier's rule holds here as forcibly as in such cases treated by means of the constricting bandage. An incision, which in general need only be a minimal one, must be made in every case in which pus is present, or in which its presence is suspected, before the suction apparatus is employed. In almost every case in which this definite rule has been broken I have observed an increase, instead of, as desired, a mitigation of the pain experienced by the patient. In almost every suppurative case in which an incision, usually a mere puncture, has been made prior to the application of the suction glass there has been noticed a speedy mitigation of pain and a sensible improvement in the general condition of the patient. As in the case of the constricting bandage, I find it impossible to lay down general rules for the guidance of the surgeon relative to the duration of the application of the suction treatment. In acute, inflammatory conditions I usually make use of the suction treatment for half-an-hour twice daily. The suction glass is applied for five minutes, and is then removed for five minutes. This interval allows the greater part of the œdema and hyperæmia to subside. I then re-apply the suction for five minutes, and again remove it. The treatment is thus carried on for one hour twice daily, during which period the suction glass will have been "on" for half-an-hour, and "off" for the same time. In almost every instance the novice will, at first, apply too strong suction. This will almost immediately elicit a complaint of increase in the pain from the patient. In this event, as always in Bier's treatment, we have a clear indication that our treatment is in error, and the force of the suction must be at once diminished.

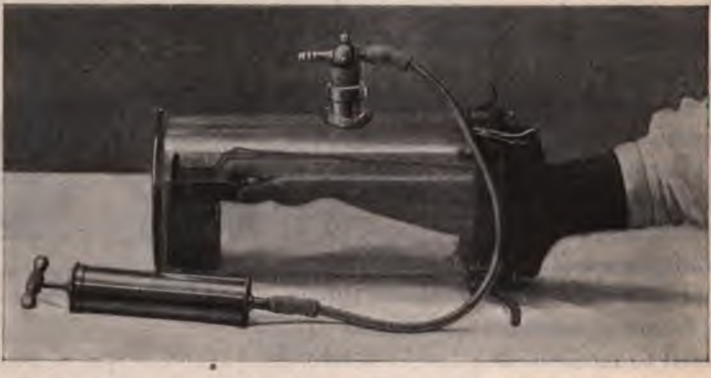

FIG. 3.—Large suction glass for forearm. (Willy Meyer & Schmieden.)

In many cases in which the presence of pus has not been suspected I have noticed that the patient is unable to bear even very moderate suction. He complains either that the pain previously experienced is markedly increased or that pain has arisen in the part which, prior to the application of the treatment, was painless. The novice might readily imagine that Bier's treatment was in such a case productive of harm. The expert knows that pus is certainly present. He makes a tiny incision into the centre of the inflamed area, evacuates pus, re-applies the suction more forcibly than before, and is soon rewarded by the statement of the patient that the part is now free from pain. In this instance, once again, Bier's treatment proves its diagnostic value. It will be readily understood that the suction treatment applied immediately subsequent to the making of an incision into a suppurating part causes at first a very free escape of blood and pus into the interior of the suction glass.

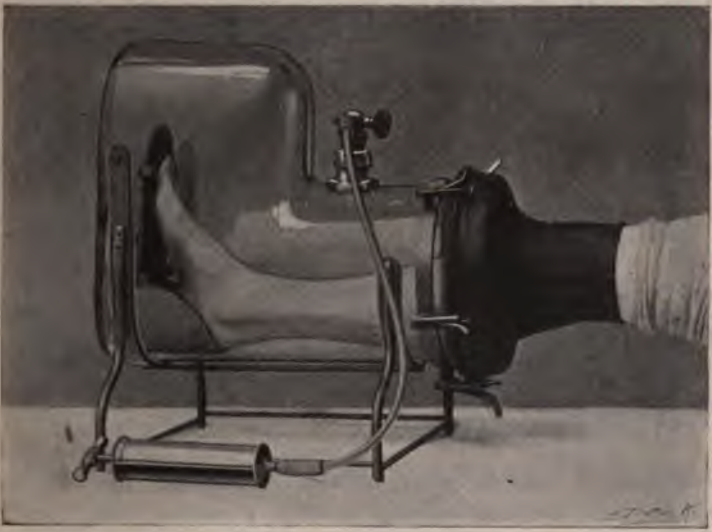

FIG. 4.—Large suction glass for foot and ankle-joint. (Willy Meyer & Schmieden.)

The more copious the immediate discharge the sooner, as a general rule, it ceases, and the more marked the relief from pain and the more rapid the cure of the inflammation.

Herr Klapp, who has been Professor Bier's assistant for a long period, has, very ingeniously, constructed several large vacuum glasses provided with powerful suction pumps and furnished with specially devised rubber cuffs, which encircle firmly the limb just proximal to the glass jar, for use in the case of affections of the upper and lower limbs. Into such large suction glasses the arm or leg can be inserted in order to subject it to the suction treatment.

Great as is my admiration for Klapp's ingenuity in constructing such suction glasses, I cannot recommend their employment to my readers, save in exceptional cases. In my experience they are costly, and a special apparatus is needed for each individual joint and for each patient, as the dimensions of the limbs in various patients differ in essential details.

A still more prevailing objection to their general employment is the fact that the results obtained from their use are, in general, distinctly inferior to those secured by the far cheaper and simpler elastic bandage.

In my experience, in any cases in which both the suction treatment and the constricting bandage are equally applicable, *e.g.*, in affections of the arm and leg, the advantages of the latter are overwhelming.

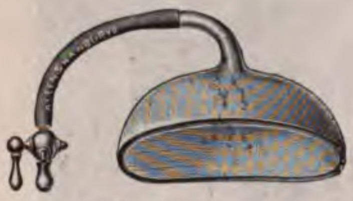

FIG. 5.—Suction apparatus for breast and back. Greatly reduced in size.

Regarding the suction-glass treatment, I may state my opinion that in all superficially situated suppurative conditions involving the trunk, in contra-distinction to the extremities, in which, prior to the application of the suction apparatus, an incision, usually a mere puncture, has been made into the affected area, the suction treatment has certainly been productive of good. In every case the inflammatory process has been mitigated. When sloughs have been present their removal has been hastened, and this without causing pain, and the suppurative lesion has healed in less time than one would have considered probable under any other method of treatment.

I have employed the suction treatment especially in the following conditions:

(1) In cases of *mastitis*, with or without preliminary incision, depending upon the presence or absence of pus. In the majority of instances no incision was made, and the entire breast was encircled by a large cupping glass, to which a suction pump was attached. The results in such cases have proved most satisfactory.

(2) In *carbuncles and furuncles* after incision, and in blind boils without incision. In such cases the results have certainly exceeded those obtainable from any other method of treatment.

(3) In *acute abscesses* after a small incision has been made to give exit to pus.

(4) In the treatment of *chronic abscesses*, particularly where it was desired to obtain closure of a persistent sinus, *e.g.*, in tuberculous abscesses, and in chronic empyemata in which a small cavity resisted all efforts directed towards its obliteration.

I have no hesitation in stating that in my opinion in the large majority of the above-mentioned cases the suction treatment afforded results superior to those likely to be attained by any other method of treatment.

In addition to the above-mentioned instances, in which the result of the suction treatment was, as a rule, markedly beneficial, I have employed it in many cases of lupus, especially of the face, in the treatment of post-operative keloid cicatrices, in otitis media suppurativa after incision or rupture of the membrana tympani, in both acute and chronic types of the affection. In many of the above-mentioned cases the suction treatment appeared to be of distinct service; in but few cases, however, was the benefit obtained very striking. I may add that certainly in no instance did it prove in any degree harmful.

Hyperæmic Treatment by Means of "Heated Air."—It is well known that hyperæmia is produced by subjecting any part of the body to the direct influence of heated air. Bier has employed hot air as a therapeutic agent with results that have impressed him as to the value of the method in numerous affections. The induction of hyperæmia by means of heated air is Bier's third method of treatment. Warmth has been for centuries employed in the treatment of inflammation, especially in the form of hot fomentations and hot baths, and more recently by means of hot air generated by electrical apparatus of various kinds. The hyperæmia produced by hot air differs essentially from that caused by the two former methods, in that it is a purely arterial, as opposed to a venous, hyperæmia. *A priori*, it would appear probable that an arterial hyperæmia would be greatly superior to venous congestion in its curative results.

In my experience, however, this is the least satisfactory of Professor Bier's three varieties of hyperæmic treatment. My experience of it is, I confess, far less extensive than of the two former methods. In acute inflammatory conditions I have rarely derived satisfaction from its employment. I have chiefly made use of the hot-air treatment in cases of chronic stiffness of joints resulting from acute inflammation, and in such I have convinced myself that it has a distinct and potent influence in hastening the absorption of the products of inflammation which tend to cause partial fixity of the affected joints. I also know it to be of real benefit in the treatment of neuralgia. I have found the forms of heated-air apparatus supplied by instrument makers costly, by no means easy to manage, and requiring constant attention and painstaking supervision on the part of the medical attendant or of a specially trained nurse.

Further, in spite of the fact that in every instance in which I have recommended the employment of the heated-air chamber, I have been careful to give an earnest warning to all concerned regarding the possibility of their occurrence, in two cases patients have received severe burns. When I repeat that the advantages derived from the hot-air treatment have been, as a rule, inferior to those attained by the other methods, it will be evident that heated air should be the last and not the first method to be suggested, except, of course, in cases in which it is the only hyperæmic treatment possible.

I would therefore, at present, incline to limit the use of the heated-air treatment to (1) cases in which the object is the expediting of the absorption and removal of chronic exudations and adhesions in joints, and (2) the treatment of neuralgia which has resisted medical treatment, and in which the surgeon has to choose between operative treatment and that by means of heated air. Such a choice admits of no doubt in general. The decision must be in favour of the simpler method, *i.e.*, that accompanied by the minimum of danger, viz., hot air.

Dry hot air may be employed at a very high temperature without giving rise to damage to the tissues or occasioning pain. It is essential, however, that the hot air be *dry*. Were the air moist, a serious scald might easily be caused.

In carrying out the heated-air treatment Bier employs two forms of apparatus: (1) The hot-air chamber; (2) The hot-air douche.

(1) **The hot-air chamber** is, in its simplest form, a wooden box, which may readily be constructed by an amateur carpenter. The box must have openings, one of which has joined to it some form of cuff made of a non-heat-conducting substance (felt answers admirably) to encircle the limb outside the chamber.

This cuff should be furnished with a tape or string at the opening furthest from the box, in order that it may be applied to the limb, only sufficiently tightly so as not to interfere with the venous return from the affected part inside the chamber.

In addition to this large opening furnished with the felt cuff and intended for the entrance of the limb, other openings in the hot-air chamber are required: one for the entrance of the hot air, another for its exit. It is essential that the air shall be in free movement. The chamber had in all cases better be larger than smaller, in order to permit the free circulation of the hot air. The freer the movement of the hot air in the chamber and the larger the opening for the exit of the hot air, the less the danger of the hot air becoming too moist owing to the admixture of watery vapour arising from the perspiring limb. In this treatment, as always, the sensations of the patient form the surgeon's best guide.

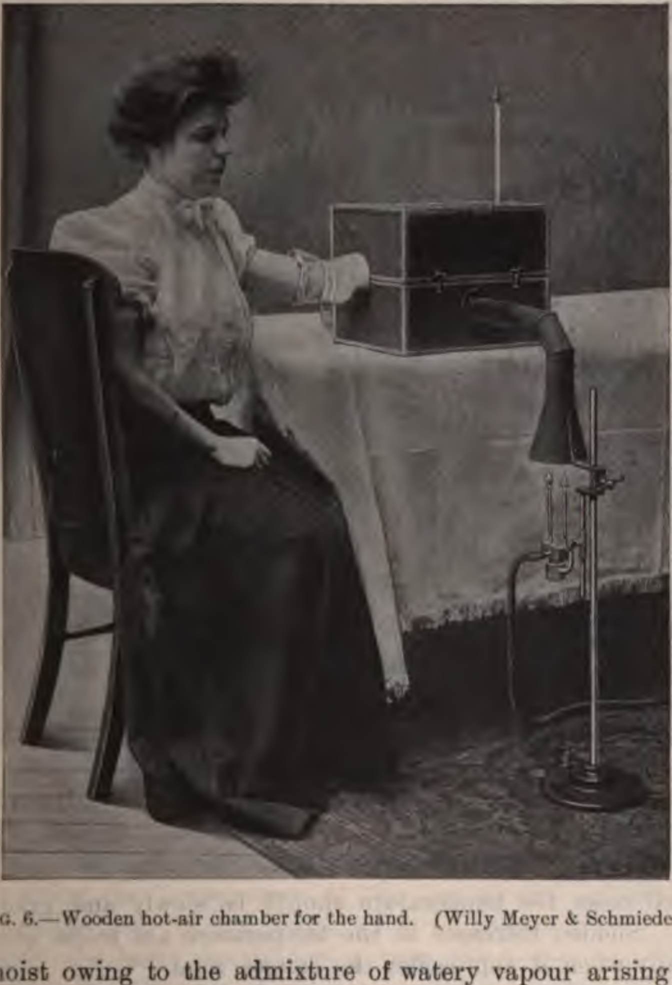

FIG. 6.—Wooden hot-air chamber for the hand. (Willy Meyer & Schmieden.)

No pain must be experienced by the patient. If complaint of pain is made the treatment is wrong, and the error must be immediately remedied. In this treatment, however, experience has taught me that too implicit reliance must not be placed upon the patient's sensations. I have frequently noticed that at the high temperatures employed, the sensation of the part may be deadened, or even annulled.

I therefore urge that, in every instance, a thermometer be inserted through a small opening in the lid of the wooden chamber in such a manner that its bulb lies inside the box and its marked stem is outside the cavity, in order that, at any time, the temperature inside the chamber may be easily noted.

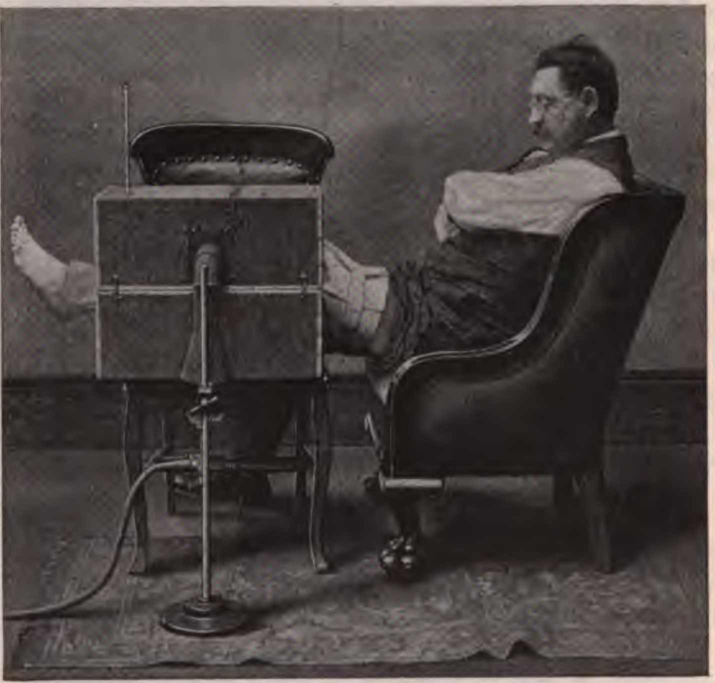

FIG. 7.—Hot-air chamber for knee-joint. (Willy Meyer & Schmieden.)

In all cases the temperature should be slowly and gradually raised. Sudden increases in the temperature are to be avoided, especially when it approaches the danger zone.

It is not a matter of great importance how the air is heated. The source of the heat may be a spirit, oil or gas lamp, and in country practice it is commonly necessary to employ one of the above. In town practice an electric heater is to be preferred. Except when the heat is generated by electricity, the source of heat must be outside the chamber, and the opening into the latter be furnished with an inverted metal funnel, whose wider end is placed above the chimney of the lamp, whilst the narrow end is connected to a short tube which enters the hot-air chamber. It is essential that the wood used in the construction of the hot-air chamber be thoroughly dry, as otherwise resin may sweat out and burn the patient. The wooden chamber should be lined with thick felt, and the whole be soaked in some silicate solution in order to minimise the danger of the apparatus catching fire.

The question now arises: What temperature should be considered the maximum in the hot-air chamber?

No doubt a higher temperature can be borne, but I place the absolute limit, beyond which it is not wise to go, at 250° F. Generally I content myself with a temperature of about 230° F.

I am well aware that others have employed, with safety, temperatures higher than those I have recommended. I write, however, for the inexperienced, not for the expert, and I urge the way of caution, especially as I find that the temperatures above indicated have afforded me as good results as are claimed by those who make use of higher (and I think dangerous) degrees of heat. It is within my knowledge that gangrene and severe burns have resulted from the use of such degrees of heat, and I would here repeat my warning that intense heat, *e.g.*, 250° to 270° F., may so annul the sensibility, especially in the móst peripheral parts in fingers and toes, that its harmful results may not be appreciated until after removal of the hand or foot from the hot-air chamber. The duration of the treatment is a matter of importance. My rule is to apply the heated-air treatment for half an hour once a day. This means that the limb remains in the hot-air chamber for at least one hour. The reason for this is that I consider it advisable that the temperature should be gradually raised, and as gradually diminished. I generally employ the first quarter of an hour in slowly raising the temperature of the hot-air chamber to, say, 230° F.; I leave the part exposed to this degree of heat for half an hour, and employ the last quarter of an hour in gradually diminishing the temperature of the hot-air box to something approaching that of the room, as it is inadvisable to remove suddenly the freely sweating part from the hot-air chamber and to expose it to the air of the room without preliminary cooling. It will be obvious that the hot-air chamber treatment is only applicable to affections of the extremities.

The Hot-air Douche.—Of this method of treatment my experience is comparatively small, but it has been, on the whole, satisfactory.

I have employed a simple form of apparatus, the constituents of which are a large metal funnel fixed with its wider end downwards. A spirit or oil lamp serves as the source of heat, and is placed several inches below the funnel. The narrow upper end of the funnel has connected with it a copper tube, to which it is attached by means of a universal joint. The copper tube, about 30 inches in length, terminates in a rose like that of a watering-pot, but provided with larger perforations.

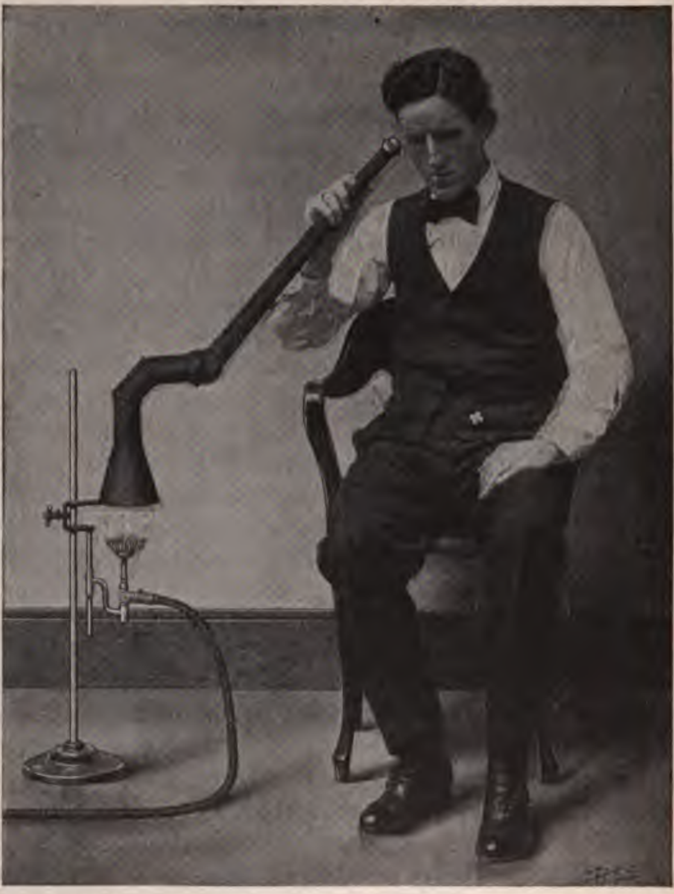

FIG. 8.—Hot-air douche for trigeminal neuralgia. The eyes must be closed. (Willy Meyer & Schmieden.)

Should, however, it be desired to concentrate the current of hot air over a very small area, the rose extremity is not employed.

In every case the free end of the metal tube requires to be covered with an asbestos envelope, or the hand directing the spray of hot air should be covered with a non-conducting glove, *e.g.*, of asbestos. A serious objection to this method of treatment is the difficulty of accurately estimating the temperature of the hot air when it reaches the surface of the skin. Clearly the more nearly the free end of the tube approaches the part, the higher the temperature of the hot air that comes in contact with it. In carrying out the treatment by means of the hot-air douche it is advisable to make use of a thermometer to check the temperature, and to gradually bring the affected part nearer to the end of the tube, *i.e.*, to approximate the part to the hot air rather than to have to remove from a lesser to a greater distance from the source of heat a part in danger of suffering from the effects of a burn.

In general it may be stated that the correct temperature is the maximum that can be borne without causing discomfort. I prefer to employ the hot-air douche for two periods lasting a quarter of an hour each per diem. I have chiefly made use of the hot-air douche in cases of neuralgia that have resisted medicinal treatment. In such instances the time at which the neuralgic pain commences or attains its maximum can frequently be foretold, and it is advisable to select this time for the application of the hot-air douche. Concerning the results of the hot-air douche, I have learned that it is unwise to prophesy what will be the results of the treatment. It not infrequently happens that in two cases to all appearance similar in etiology and symptoms in one the therapeutic result will be a brilliant success, in the other no mitigation of suffering will be attained.

I have chiefly employed the hot-air douche

(1) In cases of sciatica, with the result that in two cases out of five marked relief has been experienced, whilst in the remaining three little or no benefit has been observed.

(2) In cases of neuralgia affecting the cranial, especially the trigeminal, nerve, and also the great occipital nerve. Such have afforded, on the whole, very satisfactory results, and have, in not a few instances, avoided the necessity of operative treatment. Certainly the effect of the hot-air douche should be tried in all such cases, before the question of operative interference is even contemplated.

(3) In cases of chronic osteitis of pyogenic, traumatic, or syphilitic origin, especially in those involving the mastoid process and the tibia, both superficially situated bones.

It is worthy of note that two intelligent patients suffering, the one from chronic pyogenic inflammation of the mastoid process, secondary to middle-ear disease, the other from chronic osteitis of the upper end of the tibia (the result of pyogenic osteomyelitis in childhood), have employed the hot-air douche daily for more than three years with entire satisfaction regarding the relief of the continuous pain from which they previously suffered. In both the above-mentioned cases operative treatment had failed to obtain more than a temporary relief from the characteristic boring pains in the affected bone.

I desire to state that in this article I am conscious of the fact that the instructions given above do not, in every detail, accord with those laid down by Professor Bier. They represent merely the opinions of a surgeon who has studied Bier's method, and has attempted to give, in brief, the results of his own experience. I believe, however, that they will be found to differ from Professor Bier's directions in no essential principle. In conclusion, I would desire to emphasise the fact that, for the successful carrying out of Professor Bier's treatment, faith in the value of the method, an intelligent appreciation of its aims, and a watchful perseverance are essential. The treatment, potent for good as I know it to be under the supervision of an intelligent, careful and experienced adviser, may readily become an instrument of irreparable damage in the hands of one who is careless and ignorant of the dangers that may arise, and for this reason I venture to urge upon the reader the advisability of a further study of the method in one of the two authoritative works previously mentioned in this article.

HERBERT F. WATERHOUSE.

CLIMATOLOGY.

INTRODUCTION.

THE statement is sometimes made that climate is useless in the treatment of disease. Such scepticism denotes a certain insularity of science, the insulation of facts into disconnected heaps, whereby their mutual relationship is concealed.

When we consider the various regions of the earth from the equator to the poles, we become aware that climate dominates all living things, whether animal or vegetable, whether on land or in the sea.

The gardener or the woodman can say whether a herb or a tree will thrive best in a hot or in a cold, in a moist or in a dry climate. Naturalists can give the same information concerning the reindeer or the camel. The physician should with even greater certainty be able to indicate the fittest climate for a given person. By what means can he arrive at a correct decision? In what way is the human machine affected by heat and by cold, by moisture and by dryness of the air, by the low atmospheric pressure of the mountains and by the ordinary barometric pressure at sea-level?

The human organism is a form of slow-combustion stove, with a self-regulating arrangement for the maintenance of uniform temperature. Food, the fuel employed in this stove, furnishes the same amount of heat by the process of slow oxidation as it would furnish if burnt rapidly. To keep the machine going at all a certain amount of fuel has to be burnt, an amount almost identical amongst warm-blooded animals in proportion to the weight, or, still more closely, in proportion to the surface-extent of the animal, but increasing or diminishing in a definite manner according to temporarily acting causes. The heat-production has been shown by experiment to occur almost exclusively in the muscles; and when an increased rate of production is called for the demand is met by increased muscular activity, which may take the form of involuntary twitching, shivering, or heightened tension without obvious movement, or it may take any form of voluntary exercise. In all warm-blooded animals metabolism becomes more or less active in correspondence with the varying heat-removing conditions.

At one time it was supposed that in the Tropics a smaller amount of food would be necessary than in the Arctic regions.

As a matter of fact, however, the human machine, like a steam-engine, requires the same amount of fuel for a given output of energy, whatever may be the external temperature. The external temperature makes a difference, not in the amount of energy transformed, but rather in the working of the machine. Both in the human machine and in the steam-engine a large amount of the energy is transformed into heat, not into work; and if the surrounding temperature hinders the removal of heat, the machine may become dangerously over-heated.

Though heat will not serve instead of food as a source of energy, the smaller demand for heat-production may render the continuance of life possible in a warm climate for a person of such low vitality as to be unable to produce more than the minimum necessary to keep the machine running.

At the other extreme of the scale, in the Arctic regions, where the demand for heat-production exceeds the possible output of the machine, man has an advantage over other animals in being able by artificial means to withdraw himself or to shield himself from the influences of an unsuitable environment. The Greenlander and the Eskimo, by means of dwellings and abundant clothing, can live permanently where the climatic demands can hardly be complied with by any other animal.

Man has thus artificially extended his power of response to the demands of climate, and this fact brings into prominence another element of great practical importance, the means by which the human organism adapts itself to its environment. The different races have shown widely varying capacity for climatic adaptation. Differences between individuals of the same race are not less marked than are the differences between the races themselves.

This question of climatic adaptability is a far-reaching principle in Medical Climatology, but will be more fittingly discussed when we have considered the chief elements on which it depends. Attention is drawn to it here only in order that it may be kept constantly before us.

In the foregoing sketch we see the working of two great principles: the action of climate and the re-action of the organism. Another principle, in restriction or limitation of these two, will furnish the entire foundation of Medical Climatology. Usually the interests of the organism as a whole are the same as the interests of the individual parts, but occasionally there is a conflict of interests. A cold, dry mountain climate might be the most suitable for a case of tuberculosis, but for the presence of an irritable larynx, which requires a warm and not very dry climate.

Medical Climatology has been heavily weighted with multitudinous facts, interesting, no doubt, though of no special value from a medical point of view. Happily we shall find that the relevant facts can be so grouped as to suggest their own interpretation and application.

Warning must be given in regard to a fundamental misconception, a source of error both in theory and in practice. Medical Climatology is sometimes supposed to furnish a body of empirical knowledge as to the particular type of climate suitable for a particular disease. The holder of this view can go right only by accident, by missing the wrong road. The proper question is not: Is such and such a climate good for such and such a disease? but, Is it good for the particular patient who happens to have the disease?

The whole subject may be enormously simplified by the substitution of fundamental principles for trivial rules—rules of only limited application. The three following propositions or general laws supply an adequate basis for the rational employment of climate in the practice of medicine:

LAWS OF MEDICAL CLIMATOLOGY.

(1) **The First Law, or Law of Climatic Demand.**—The chief physiological influence of climate lies in the demand for metabolism, a demand ranging from an amount so great to an amount so small that at each extreme of the scale it taxes to the utmost the adaptive power of the human machine.

(2) **The Second Law, or Law of Individual Response.**—The physiological optimum of climate—the heat-demand corresponding to that degree of functional and nutritional activity most favourable to the well-being of the organism—is not absolute, but is relative to the individual power of response.

(3) **The Third Law, or Law of Local Requirement.**—The climatic factors most favourable to the organism as a whole may lack the qualities most favourable to the morbid local condition, or even may have a directly injurious action on the diseased part.

LAW OF CLIMATIC DEMAND.

In connection with the demand for metabolism an important characteristic must be noted, the *regularity* or *irregularity* of the demand. This distinction, not generally recognised, is one of the most fundamental in the whole range of Medical Climatology. By confusion of thought, the facts denoted are ascribed to equability of temperature. A dry, equable temperature is frequently advised, though such a combination as dryness and equability of temperature is not to be found on the face of the earth. Equability of atmospheric temperature requires of necessity a high degree of moisture. Dryness of climate is invariably conjoined with great oscillations in temperature.

The confusion arises from the discordant judgments arrived at by bodily sensations and by the readings of the thermometer. In warm, moist air, a slight fall in temperature affects the thermometer only a little, while it causes a bodily sensation of disagreeable cold. In warm, dry air, a large fall in temperature, affecting the thermometer greatly, may pass unnoticed as regards bodily sensation. As the thermometer is rarely at hand, the varying sensations of heat and cold are naturally, but erroneously, referred to changes in atmospheric temperature. The underlying fact is covered by the distinction now pointed out, the regularity or irregularity of the heat-demand.

The regularity or irregularity of heat-demand depends on different conditions, according as the temperature of the air is high or low. In warm air, the irregularity of demand depends on a high degree of humidity; in cold air, on the amount of wind.

A warm, dry climate, notwithstanding its great oscillations in temperature, is regular in its demand for metabolism. The demand varies widely in amount during the course of the day, but with fair regularity from day to day at the same hour. In dry air, moreover, the demand is not so insistent as in moist air, and it can be controlled by means of clothes. Dry air has the further advantage of permitting the removal of any heat produced.

Warm, moist air, on the contrary, notwithstanding its equability of temperature, is an irregular heat-removing agent. Owing to the heat-absorbing and heat-storing capacity of water-vapour, a very slight fall in temperature causes an enormously increased heat-demand. Against the removal of heat by conduction, clothes afford little protection, especially when damp. The skin, too, which unaided served our ancestors as a protective against weather changes, is inefficient against moist cold. Dry cold constricts the surface-vessels, and the skin, though itself cooled, hinders the removal of heat from the subjacent parts. In moist air a slight fall in temperature, insufficient to constrict the surface-vessels, carries off stealthily a large amount of heat, chilling, it may be, both the blood and the subjacent organs.

Cold air at its highest degree of humidity contains so little moisture that its water-vapour has hardly any effect, either in removing or in hindering the removal of heat, except in so far as by precipitation it impedes radiation. In the case of cold air, irregularity in heat-demand is produced by wind, convection now coming into play.†

The importance of the mode of heat-demand, whether regular or irregular, arises from two sources: its influence in modifying healthy function and its influence in causing disease.

The advantage of a regularly alternating large and small heat-demand is in harmony with the working routine of all the bodily functions. Every organ of the body fulfils its purpose by alternating repose and activity, by the alternate storing and discharge of energy, each with its own rhythm. Every organ concerned in the process of digestion has an appointed time for undertaking its own special duty. The nervous system has another rhythm: expressed in the waking and sleeping states. Then in the grand harmony of functions each in turn dominates the orchestra. When digestion leads, the performance is improved by the genial accompaniment of the higher nerve-centres at the dinner-table. When the higher nerve-centres lead, the digestive process must be just sufficiently active to be unperceived. Hunger, no less than repletion, is a hindrance to mental work. Those functions that seem to be continuous, circulation and respiration, are, in fact, the most conspicuous examples of rhythmic activity and repose. Each beat of the heart is made up of alternating rest and work. Each respiration is a cycle, the muscles active during one-half of the process, resting during the subsequent half.

The regular fluctuations in heat-demand characteristic of a dry climate correspond with the physiological rhythm of energy-production and discharge. In a moist climate, on the contrary, the heat-demand is irregular, and is discordant with the physiological rhythm of the organism. A dry climate is felt to be stimulating or bracing unless its heat-demands are beyond the individual range of response. In a moist climate the heat-demand is apt to be untimely and fruitless; while when the organism is ready for its periodic discharge of energy it has difficulty in getting rid of the heat produced.

Temperature is the most important element in climate, and it affects the bodily functions mainly by virtue of its action in increasing or diminishing metabolism.

Excessive heat and excessive cold alike lower the vitality of the whole organism. Death results equally from insufficient and from over-great removal of heat. Between these limits a change of temperature is helpful or hurtful according to the individual capacity of response. The optimum of temperature varies widely from person to person, both in mean level and in range; occasionally the optimum is to be found in the equatorial regions; but never within the Arctic Circle. A depressing influence on all the functions of life—long before the fatal limit is reached—results as the extremes are approached.

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† Further details are to be found in my "Handbook of Climatic Treatment."

A white man living in the temperate zone and going to a warmer country is usually less inclined for active exercise, the appetite consequently diminishing. K. E. Ranke found that when in the Tropics, if he took the minimum amount of food necessary to replace his lowest possible tissue-change loss, he felt ill; while if he took only the amount with which he had a sense of physical well-being, he lost weight.

The influence of temperature on the digestive system is partly the outcome of its action on tissue-change, and partly the outcome of its action on the circulation. Some valuable observations may be quoted from Birch's instructive article in Davidson's "Geographical Pathology":

"A tropical climate suits some enfeebled people admirably—their appetites improve, and they become capable of greater muscular exertion. The external warmth seems to be necessary to stimulate their functional energy. Such persons seem not to be capable of manufacturing sufficient bodily heat in a temperate climate; but the warmth removes the great tax which was formerly placed upon their organism in the endeavour to do so, while the skin, which was before inactive, perspires freely, relieving the digestive and other organs from their condition of apathy. To old tropical residents, to whom anæmia or general cachexia has become a chronic state, removal to the hills is hateful; while they remain on the plains they are perfectly happy, and consider themselves to be in good health. The weak-chested and scrofulous, in Martin's opinion, benefit by residence in the Tropics; and the experience of others confirms this statement. On the other hand, it should be stated that cases of developed pulmonary phthisis succumb rapidly."

The change to a colder climate is generally beneficial. The increased metabolism called for necessitates an increased amount of food. By this process the digestive system is stirred into activity, always provided that the cold of the new climate is not beyond the person's power of response. Where the cold is so great that the digestive and assimilative powers are unable to meet the demand, diminished, not increased, activity of the digestive system results. The person with high digestive and assimilative capacity finds the change "bracing." The person of feeble assimilative capacity finds the change "relaxing."

A prevalent idea until recently has been that in the Tropics anæmia occurs, and hyperæmia in the Arctic regions. This opinion appears to have arisen from the fact that many residents in the Tropics suffer from anæmia due to malaria, and that others again have a certain pallor due to the avoidance of the tropical sun, though as a matter of fact not suffering from anæmia. Glogner, Eijkman, Plehn and others examined independently the blood of many residents in the Tropics, and found the number of red corpuscles and the amount of hæmoglobin to be the same for the European in the Tropics and at home, and to be the same also as in the native races. Further researches on the subject are desirable, but the position of the question now is that anæmia, when present, is probably due to malaria or some other illness, or to bad hygienic conditions.

Similarly the plethora that used to be ascribed to the Greenlanders and other residents in the Arctic zone is not yet known to be a fact.

The physiological influence of temperature is admirably illustrated by the changes which occur with the well-known Föhn wind of Switzerland. This wind, when it occurs in winter, changes in a remarkable manner the heat-removing conditions of the environment, and consequently changes also the physiological processes by which the organism must adapt itself suddenly to the altered demand. Mid-winter seems to be transformed into mid-summer. The man of active muscle finds the change enervating, while the person of low vitality feels braced by the lessening of the demand.

A curious effect, however, noted almost equally by those who feel braced and by those who feel oppressed by the Föhn, is the tendency to nervous irritability. This effect is probably the outcome of two or three different factors: Greater abundance of stimulant rays from the sun; increased atmospheric dryness; and probably altered electrical conditions.

As a consequence of the physiological action of humidity and wind in varying combinations with temperature, certain ailments, known as chill-producing diseases, occur in every latitude, from the poles to the equator: diseases not due to heat or to cold, but to certain alterations in the demand for heat-production—a demand which the organism is not prepared without notice to furnish.

The share taken by cold and moisture in giving rise to these ailments is of the kind to which J. S. Mill gave the name of concause, which, though not actually a cause, may in some instances reach the level of an indispensable condition. Our knowledge of the processes concerned is not sufficiently exact to enable us to place the various antecedents in order of demerit. But no observant physician has, so far as I am aware, ever discarded cold as a concause of disease—notwithstanding the tendency of an occasional laboratory worker to dogmatise beyond his test-tubes, and to lay down the law as what is possible or impossible clinically, in a region altogether outside his experience.

An example may be given. A patient drilled in the "open-air treatment" in England is sometimes directed to follow the same routine in the much colder climate of an Alpine mountain station in winter. Not uncommonly a bronchial catarrh, a pleurisy, or other accident teaches the victim that "open-air treatment" alone does not embody the whole science of medicine in regard to the management of pulmonary tuberculosis.

What is the real position of "open-air treatment" in Medical Climatology? The "open-air cure" is only a particular mode of climatic demand for active metabolism. In some persons the result is increased metabolism with improved general nutrition, and consequently greater disease-resisting power. In other people the demand is beyond the feeble powers of the organism. The consequence is impaired nutrition with diminished disease-resisting force.

The most important elements in "open-air treatment" are, first, the substitution of the pure outside air for vitiated or stuffy air indoors; and, next, the employment of a more actively heat-removing environment. "Open-air treatment" may become a source of harm if the underlying principles are not kept in view; but when selected because of its essential appropriateness the result will always be satisfactory. Reference to fundamental principles would show whether the climate might not with advantage be artificially modified in one direction or another according to the needs of the individual case.

The most desirable conditions for a certain patient might be furnished not by the raw climate as supplied by nature, but by a climate freed from impurities, and scientifically adapted to the individual necessities. Thus, greater benefit might be obtained by a slight modification of the local "open-air" conditions than by a long, costly, and dangerous journey to a country where these conditions are supposed to prevail naturally—a supposition not always borne out by the facts.

The influence of barometric pressure is almost entirely indirect.

Paul Bert showed that alterations in atmospheric pressure affect animal and vegetable life, not by virtue of a mechanical action, but by virtue of the amount of oxygen present. Oxygen, moreover, is employed in the animal organism not in proportion to its amount, but according to the requirements of the tissues. Occasionally we hear opinions expressed which assume as a matter of course that an abundant supply of oxygen will of necessity cause increased activity of intra-organic oxidation. This may be the effect, but only if the supply of oxygen had previously been inadequate.

Owing to purely physical laws, air becomes colder with expansion. The temperature of absolutely dry air would fall 1° C. for every 101 métres; but owing to a number of disturbing influences the rate of fall is very considerably modified. The general fact, however, remains, that the temperature of the air on the mountains becomes lower and lower the higher we go. Thus it happens that in the Tropics the mountain-side presents all varieties of vegetation, from the tropical at sea-level, through the sub-tropical and the temperate, to the Arctic zone, where vegetation ceases; and then the line of perpetual snow is reached. Fortunately, in India and some other tropical countries, hill stations place a temperate climate within easy distance. Where this opportunity of change can be freely used, the white man can often live for years, retaining his health in the Tropics. At best, however, the hill station is a poor substitute for the temperate zone. The tropical sun, the great range of temperature, the prevalence of dysentery and other tropical ailments, carry with them dangers from which the European is free at home.

In any case, experience, up to the present, warrants the opinion that no European family can settle down in India and live from generation to generation in undiminished vigour without returning to the latitude of their race.

An important physiological action of diminished barometric pressure is the increase in red corpuscles with altitude, an increase roughly of 70,000 corpuscles for each 100 métres.

The breathlessness of even the most robust person after exercise in the mountains as compared with the plains is due to the difficulty of supplying oxygen quickly enough to replace what is used. The blood can take up oxygen fast enough for the needs of the body at rest, but cannot keep pace with the increased demand, when at the same time the oxygen is supplied under lower tension. If in addition to the deficiency of oxygen in the air the oxidising apparatus be defective, the failure to supply the needs of the system may be attended with serious or even fatal results. A weak or damaged heart, or insufficient aërating surface in the lung, whether from emphysema, or other disease of the lungs or pleura, may thus greatly limit a person's power to live in air even slightly rarefied. Another very common impediment to the action of heart and lungs is flatulence. Not merely the discomfort, but the danger, arising from this source may be as great as that arising from serious organic lesions. In addition to the mechanical effect due to the compression of the lungs and displacement of the heart by the distended stomach and bowels, there is commonly a reflex irritant action on the heart. Elderly, fat and constipated women are especially apt to have serious trouble from this source, and the condition becomes grave if misinterpreted or not properly dealt with.

A certain relationship of diminishing frequency of tuberculosis with increasing altitude is observable—a relationship evident, though by no means close.

LAW OF INDIVIDUAL RESPONSE.

The rate of heat-demand most favourable to the organism is not the same for everybody, but depends on each person's power of response. This law directs our attention to the means by which the organism adapts itself to its environment. A correct estimate of the patient's power of response is indispensable for the selection of a suitable climate. The neglect of this principle is one of the two great causes of failure in the choice of climate for patients; the other great cause of failure being inattention to the local requirements of the disease, the subject of Law III.

As oxidation takes place chiefly in the muscles, one of the conditions favourable to a high capacity for response is a sound and active muscular system. Not less important are the following: a good respiratory system; sound blood-vessels with good tone; sound heart with vigorous muscles; good blood—sufficient red blood corpuscles, with hæmoglobin in at least normal amount; a good digestion, whereby fuel is supplied to the blood. If any one of these conditions is absent, intra-organic oxidation is hindered. A weak heart, toneless arteries, deficient aërating lung surface, flabby muscles, anæmia, all tend to impede the oxidation processes. We may at times have difficulty in determining whether a lacking condition can be compensated for by those that are present. At any rate, if we recognise the weak point, we may be able to strengthen it, or at least to shield it from undue strain. Many people have little capacity of adapting response to demand. A sudden demand for an enormously increased output of energy, or the absence of a demand for the customary amount of energy, will equally derange the equilibrium.

Not infrequently we find the capacity for a great output of heat in combination with a capacity for modifying the output according to the demand. Such elasticity probably depends on a stable nervous system, which will allow its owner to take things quietly. A restless, fidgety or worrying person is apt to be taking active exercise all day, and even all night long, without knowing the amount of energy he expends. Adaptability of response fits a man equally to visit the Arctic regions and the Torrid zone. But one limitation must be borne in mind. Where the system has to strain its powers in order to comply with the demand of its environment, relaxation of the tension is welcomed; and a return to more normal conditions will certainly prove beneficial to an organism that could only with difficulty keep its heat-production up to, or down to, the demand of an unsuitable environment.

A type of case, familiar to any physician practising in the High Alps, is that of a person of feeble circulation, poor digestion, flabby muscles, and a low level of strength in the chief organs of life. Not infrequently such a person affected with pulmonary tuberculosis comes up to Davos—as a rule against medical advice—with the idea that the air of Davos has some special curative effect. The indispensable minimum of tissue-change, which the patient can just manage to accomplish in the lowlands, is not enough in the cold, rarefied air of the mountains. The patient, continuing the open-air life acquired through sanatorium discipline at home, quickly loses ground. In order to avoid a fatal result, only two lines of treatment are open. One is to send the patient without delay to a lower altitude and warmer climate; the other—only a temporary expedient—is to make an artificial climate as nearly as possible adapted to the patient's power of response.

The influence of habit in determining the rate of metabolism is not sufficiently recognised. Its influence is obvious where a great change in climate is rapidly made. For example, it is most striking when a person leaves a cold climate where the organism had become set to a high rate of heat-production. When such a person changes to a climate with small heat-demand, nearly the same amount of food is taken, which, not being burnt, is stored for future use. This is the explanation of the increase in weight that commonly takes place when a person leaves the high mountains for the warmer lowlands. A converse result is observed in the weight lost until the system adopts the habit of digesting and assimilating the greater amount of food called for by the increased combustion.

Old age corresponds with a lower general level of metabolism. Many of the diseases peculiar to old age arise from the fact that the amount of tissue-change required during the full activity o adult life is no longer called for, while the arrangements for digesting and assimilating food do not fall off in equal degree. Fue prepared for oxidation is not oxidised, but is stored up in the system as unused clogging material.

Throughout the animal kingdom the animal machine requires for its smooth running very nearly the same amount of ready energy—an amount almost constant in proportion to the animal surface, though modified by various circumstances, such as age and sex. One or two examples may usefully be considered.

The following table shows the number of calories produced per square mètre of surface in twenty-four hours :—

Grown man, medium diet, resting	1189	calories
,, ,, ,, ,, moderate work	1399	,,
Infant	1221	,,
Child, medium diet	1447	,,
Old men and women	1099	,,
Women	1004	,,

The following table † shows the nitrogenous excretion per kilo. according to age :

Age.	Urea in grammes per kilogramme.
1½ years	1·35
3 ,,	0·90
5 ,,	0·76
7 ,,	0·75
9 ,,	0·69
12½ ,,	0·54
15 ,,	0·50
Grown person	0·50

These figures illustrate an important and far-reaching law. The rate of tissue-change in a young child, corresponding with the greater activity of nutrition during the period of growth, is about half as much again as in old people, and even very much more than in a full-grown man doing moderate work. This greater nutritive activity is accomplished by means of childish muscular activity without conscious intent of satisfying the needs of the growing organism. Moreover, great individual differences are very soon apparent. One person shows the utmost facility of adaptation to great variations in the demand for tissue-change; while another seems to have lost, or at least not to have, any elasticity of response.

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† Rubner, quoted by Hammarsten, "Lehrbuch der Physiologischen Chemie," 5te Aufl., S. 665.

Experience has shown that children born in India of European parents are likely to grow up strong only if they are sent in their earliest years to a temperate climate. The explanation is simple: their metabolism is extremely active, while their environment makes almost impossible the removal of the indispensable minimum of heat produced.

Women, owing to their comparatively low rate of heat-production, might be supposed to be specially adapted for life in the Tropics; whereas they break down in hot countries more readily than men do. The explanation of this seeming anomaly is found in the stimulant or forcing action of temperature on the reproduction system. The function of menstruation begins about the thirteenth year in equatorial regions and progressively later in the higher latitudes, till in northern Europe it seldom appears before the seventeenth or eighteenth year. European women suffer more commonly from uterine ailments in the Tropics than in the home country.

Children, we have seen, at one end of the scale, represent the highest activity of tissue-change. Old people, with the lowest tissue-change, are at the other end. In this circumstance we have the explanation of the well-known fact that old people, as a rule, do well in warm climates. An important point, however, to remember is that physiological age is by no means indicated by age according to the parish register.

Climates where tissue-change is excessively small are unsuited for permanent occupation by white men, or at least by Europeans of middle and northern Europe. Nevertheless we have frequently to consider whether in certain cases men of one of the northern white races can safely reside in the Tropics.

Major Woodruff's experience that persons of dark complexion stand the tropical climate of the Philippines better than do persons of fair type is put forward by him only in reference to his view that the noxious element in tropical climates is the chemical portion of the spectrum; and that nature's defence for man is the pigmentation of the skin. The facts suggest for the individual the climatic suitability of the ancestral home, the native air of the race. Incidental support of the same view may be drawn from the discussion at the meeting of the British Medical Association in 1910. A discussion on the "Special Factors Influencing the Suitability of Europeans for Life in the Tropics" was initiated by Sir R. Havelock Charles. All the speakers with one exception considered the dark type of European more suitable than the fair for life in the Tropics. Every one who took part in the discussion laid stress on the importance of a sound nervous system. The highly strung person, easily worried, with a tendency to sleeplessness, is almost certain to break down. Next in importance is a good digestive system, including good teeth and regularly acting bowels. A tendency to constipation is no drawback. A tendency to laxity is dangerous. A temperate, level-headed man has, according to all observers, the best chance of keeping well in hot countries. Sir Havelock Charles thinks also that one should not be over intellectual. The victims of drugs or of alcohol should be absolutely rejected. This view was expressed even by those who thought that a moderate allowance of alcohol is for some persons not merely permissible but advisable in the Tropics. The subjects of diabetes and of tuberculosis must also be excluded. Cardiac trouble must be seriously weighed, in view of the liability to fevers and other weakening diseases that may still more impair the working capacity of the heart. Obesity comes under the same class of considerations, and was the subject of some divergence of opinion. Unquestionably it must be regarded as a handicap, possibly balanced by other conditions. A suspected appendix should, according to Sir H. Charles, be removed before residence in India.

The special suitability of certain races to certain temperature zones may be noted in this connection. The Eskimo belongs to the Arctic regions; the Scandinavian, the Teuton, the Latin races, the Arabs and the Negros represent more or less distinct races which thrive perfectly well where the temperature is nearly the same as in their own country; but a people migrating on any large scale to a latitude differing widely in temperature from their native home gradually die out in the new country. Successful occupation of countries warmer or colder than the place of origin has occurred only in adjacent countries where the temperature difference is not great.

In view not merely of the interest of this point, but of its importance in shaping our advice to patients, one or two general facts observed in other branches of the animal kingdom may not be irrelevant. W. P. Pycraft in his fascinating "History of Birds" gives some information concerning the migratory habits of many birds. He thinks that migratory birds visiting the British Isles "may be regarded with a tolerable degree of probability as the direct descendants of the migrating hosts which made their way to these islands when they formed part of the mainland of Europe."

Instances pointing to the value of the racial element in the selection of climate come to mind much more quickly than adverse instances. In any case, the supposition has antecedent probability in its favour; but it can only be established or disproved by long and critical examination of the facts; and as yet no sufficient body of facts is at hand to warrant a definite statement as to the influence, if any, of the factor in question. A possible ancestral influence might, however, be allowed at least a sort of casting-vote in the selection of climate when other considerations are evenly balanced.

LAW OF LOCAL REQUIREMENT.

The law of local requirement compels us to consider in what manner the diseased part may be affected by the various factors of climate. For example, brittle cerebral arteries might be exposed to undue strain by the increased arterial tension arising from colder weather or from a colder climate. The heat of summer and the cold of winter alike may cause eczema. The neglect of this law is responsible for failure in the selection of climate not less frequently than is neglect of the law of individual response.

The local action of moisture is sometimes an important consideration in the selection of climate. A common symptom of rheumatic diseases is the tendency to perspiration on the slightest exertion. Owing to this weakness the skin fails to accomplish one of its most important duties, the protection of the inner organs from rapid changes of temperature. In a dry climate, where moisture from the skin is readily taken up, the skin remains dry. In this class of disease the deep chilling, in contrast with the surface chilling by cold, dry air, lowers the temperature of muscle and of nerve beyond the physiological optimum.

Chronic catarrh of the upper air passages is, as a matter of clinical experience, in the most favourable conditions locally for recovery in a rather warm climate of medium humidity. Abundant secretion from the bronchial tubes is, as a rule, greatly diminished by a warm climate. One of the most difficult questions to decide in practice is the comparative weight that must be assigned to the various factors actually present in any given case. Pulmonary tuberculosis is commonly attended by bronchial catarrh, and sometimes also by laryngeal and pharyngeal catarrh. The tuberculosis is the most serious element in the case, but the symptoms referable to it may be less obtrusive than the symptoms due to one of its allies. The general nutrition, the most important element in the treatment of tuberculosis, may require a cold, dry climate, but the coldness and dryness may be a source of irritation to the less important but very obtrusive pharyngeal catarrh.

To determine whether the winter should be passed at home or abroad, we must weigh equally the fundamental principles and the possible limitations in applying these principles, imposed by the local disease. In other words, we must first determine whether increased or diminished activity of tissue-change is desirable from the point of view of the general health, and then we have to consider whether the special characteristics of the home climate or those of the foreign climate will be most likely to supply the conditions required by the local disease.

This point can be best explained by an example. In tuberculosis the main object of treatment is to improve the general nutrition to the highest level. Climate has no specific action on tuberculosis; it helps the patient to recover in so far as by improving his general nutrition it enables his tissues to grapple successfully with the disease. High mountain resorts such, for example, as Davos, and seaside resorts such as Margate and Berck-Plage, have equally a great reputation for their value in tuberculous disease, a reputation due, no doubt, to a similar action in both cases—increased metabolism—but attained by dissimilar methods.

The climate of Davos is characterised by rarefied, dry, cold, still air, which offers little hindrance to the rays of the sun. The climate of Margate, in contrast, is not dry, is not excessively cold, is very windy, and, owing to the prevalence of sea-breezes, the air contains a good deal of moisture, which keeps back a large proportion of the sun's rays—that is, it is devoid of almost every quality to which the virtues of Davos are commonly ascribed. The fundamental action, however, of both climates is identical. The cold, dry air of Davos and the blustery air of Margate alike demand a high rate of heat-production; and when the body responds to this demand, the nutrition throughout is improved, whereby the diseased member profits.

The case which does especially well at Davos—pulmonary tuberculosis—is apt to do badly at Margate. Cases that do particularly well at Margate are those in which glands, bones, and joints are affected. Such cases can hardly be said to do badly at Davos, but certainly they do better at Margate. When we consider the processes involved, the matter becomes clear. One condition of recovery is active circulation in the diseased parts. To secure this condition in the excessively cold air of the mountains is not easy, and for patients with feeble circulation is impossible. Whatever their ailments, such cases do not get on well in the mountains. At Margate the wind, notwithstanding its roughness, is not very cold, and there is no difficulty in keeping the local circulation in a satisfactory condition.

Here also the local action is the main factor in the result, and accounts for the fact that cases of pulmonary tuberculosis do well in the mountains, and not at a windy seaside resort. The air passages are especially apt to be irritated by rough winds, while in this respect the calmer air of the mountain resort allows the other factors of the climate to yield their utmost benefit.

Similarly, the local influence of the air of London in stimulating the nasal mucous membrane has been pointed out by Greville Macdonald. The shrinking of the erectile tissue of the turbinals is probably the reason why many asthmatics suffer less in London than elsewhere. The swelling of the turbinals in moist air would equally account for the aggravation of the complaint at the seaside.

Women, though they do not stand well the excessive heat of the Tropics, do not either as a rule stand excessive cold well; and for them, as for old people, a winter in the south is often advisable, generally permissible, and seldom contra-indicated—less frequently than would be the case in a man of like age and in a corresponding state of health.

CLASSIFICATION OF CLIMATES.

The questions concerning climate that the physician has most commonly to answer may be summed up under three headings:

(1) Where should this delicate child be sent so that he may get rid of his weakness and grow up strong?

(2) Where should this patient go that he may have the best chance of throwing off his ailment or of keeping at bay the disease that threatens him?

(3) Can this person go to such and such a country and take up work there without risk to his health?

The climates of the earth are infinite in number. The information is extremely scanty concerning many of the places about which we are asked, and that scanty information is for the most part utterly untrustworthy. Nevertheless, a physician acquainted with the principles underlying climatic treatment is in no danger of making any serious mistake.

And this is not surprising, for the principles upon which his decision is based are few in number and of broad application, not depending on small differences in temperature, humidity, or other meteorological factors.

The following classification, taken from my "Handbook," sums up the relevant facts concerning climates in general:

Group I.—Climates where the Heat-Demand (or Demand for Tissue-Change) is Excessively Small.

Meteorological Characters.	Physiological Characters.
Hot climates: temperature over 71·6° F. (22° C.).	Demand for heat and for tissue-change so small that there is difficulty in getting rid of the heat formed by the healthy body when production is at its lowest.
(*a*) Heat-Demand (*or* Demand for Tissue-Change) Regular.	
Dry: mean relative humidity under 60 per cent.	Fluctuations in heat-demand fairly regular and comparatively small.
(*b*) Heat-Demand (*or* Demand for Tissue-Change) Irregular.	
Not dry: mean relative humidity over 60 per cent.	Fluctuations in heat-demand irregular and comparatively great.

Wind largely increases the heat-demands made by atmospheric humidity, but does not greatly increase the heat-removing power of dry hot air.

Every type of climate is represented in India. The north-west and northern portion of India is extremely dry as well as hot during the summer months. Colonel Giles says that "in the entire American continent there is no spot that in the matter of heat is in the same field with Jacobabad, where 127° F. (52·8° C.) in the shade has actually been registered. Bombay has a hot moist climate. The mean temperature from January to December ranges from 76° to 88° F., and the relative humidity from 69 to 87 per cent. Madras has much the same type of climate, but less moist. The climate of Calcutta is also hot and moist.

Cairo represents different climates at different seasons; hot and dry from May to August, hot and moist during September and October; from November to March dry and either warm or temperate, according as the month.

Group II.—Climates where the Heat-Demand (or Demand for Tissue-Change) is Small.

Meteorological Characters.	Physiological Characters.
Warm climates: temperature 60·8° to 71·6° F. (16° to 22° C.).	Demand for heat small, but such that heat normally produced can be easily removed.
(*a*) Heat-Demand (*or* Demand for Tissue-Change) Regular.	
Dry: mean relative humidity under or about 66 per cent. (from 72 per cent. at 16° C. to 60 per cent. at 22° C.).	Fluctuations in heat-demand regular and controllable by clothes and shelter.

Meteorological Characters.	Physiological Characters.
(*b*) Heat-Demand (*or* Demand for Tissue-Change) Irregular.	
Not dry: mean relative humidity over 66 per cent.	Fluctuations in heat-demand irregular and not easily controlled.

Wind intensifies the heat-removing action of atmospheric moisture, but increases only slightly the heat-removing action of dry warm air.

The hill stations in India represent the warm type of climate during the summer months, but with varying humidity. Simla, for example, in June is dry, and in July, August, and September moist.

The Canary Islands have also the warm type of climate with medium humidity for the nine months from October to June, with a moderate degree of humidity. During the three warmer months the climate borders on the hot type, the humidity still being medium for the temperature.

Group III.—Climates where the Heat-Demand (or Demand for Tissue-Change) is Medium.

Meteorological Characters.	Physiological Characters.
Temperate climates: temperature 48·2° to 60·8° F. (9° to 16° C.).	Medium or normal heat-demand for white races.
(*a*) Heat-Demand (*or* Demand for Tissue-Change) Regular.	
Dry: mean relative humidity under or about 75 per cent. (from 78 per cent. at 9° C. to 72 per cent. at 16° C.).	Fluctuations in heat-demand moderate in amount and regular, except in so far as they depend on wind, and then controllable.
(*b*) Heat-Demand (*or* Demand for Tissue-Change) Irregular.	
Not dry: mean relative humidity over 75 per cent.	Fluctuations in heat-demand irregular and relatively large in amount. Fluctuations due to wind not easily controlled.

Wind intensifies the action of moisture in removing heat, especially at the lower temperatures.

The majority of health resorts belong to this group, and mostly to the dry subdivision.

The Riviera from November to April has a dry, temperate climate, though at Cannes, Nice, and San Remo, December or January is cool rather than temperate.

Egypt, from Cairo to Assouan, has a dry, temperate climate during December, January, and February. The remaining months are either warm or hot.

Algiers is temperate and of medium humidity in December, January, February, and March; warm in April and November.

Melbourne has a dry climate, warm or hot according to the time of year. Its chief drawback from a climatic point of view is wind, the velocity of the wind for the greater part of the year being from ten to eleven miles an hour, but sinking in April and May to about nine miles an hour. The wind is noxious on account of its companion, dust.

Cape Town has a climate ranging from temperate to warm, with fairly high relative humidity. The high table-lands of South Africa are temperate or warm, and usually dry, but rather windy and dusty.

Davos during the summer months, June till the middle of September, has a temperate climate of medium dryness, which stands in marked contrast to its cold winter climate.

Group IV.—Climates where the Heat-Demand (or Demand for Tissue-Change) is Large.

Meteorological Characters.	Physiological Characters.
Cool climates: temperature 33·8° to 48·2° F. (1° to 9° C.).	Large demand for production of heat.
(*a*) Heat-Demand (*or* Demand for Tissue-Change) Regular.	
Dry: mean relative humidity under or about 79° per cent. (from 80 per cent. at 1° C. to 78 per cent. at 9° C.).	Fluctuations in heat-demand regular and moderate in amount, except in so far as they depend on wind, and then controllable.
(*b*) Heat-Demand (*or* Demand for Tissue-Change) Irregular.	
Not dry: mean relative humidity over 79 per cent.	Fluctuations in heat-demand irregular, relatively large in amount, and not easily controllable.

Wind greatly intensifies the action of low temperature and of atmospheric moisture in carrying off heat. Clothing gives efficient protection against dry, but not against moist, cold air.

The winter climate of the United Kingdom from November to April represents the not-dry type of cool climates. The climate of Montreux from November to March is very similar.

Meran, in the Tyrol, has a dry, cool climate during the winter months. Davos and St. Moritz during two months of spring, April and May, and again two autumn months, September and October, have also a dry, cool climate.

Group V.—Climates where the Heat-Demand (or Demand for Tissue-Change) is Excessive.

Meteorological Characters.	Physiological Characters.
Cold climates: temperature under 33·8° F. (1° C.).	Very large demand for production of heat.
The mean relative humidity at the temperatures included in the present group is usually high, about 80 per cent. or more; but the absolute humidity is so small that the relative humidity has little physiological significance except indirectly through its action on cloud.	Fluctuations in heat-demand considerable, generally fairly regular, and for the most part under control, except in so far as they depend on wind.

Wind enormously increases the heat-abstracting power of a low temperature.

The cold climates are represented by the Alpine resorts from November to March. In Davos the mean temperature during these months ranges from 18·6° F. (−7·4° C.) in January to 29·3° F. (−1·5° C.) in November. The mean relative humidity is from 79 to 84 per cent., but the absolute humidity ranges from 2·29 millimètres (the elastic force of vapour) in January to 3·44 millimètres in November.

The high-lying resorts of the Rocky Mountains also have a cold climate during December, January, and February, the relative humidity ranging from 53 to 55 per cent. These figures are remarkably low in comparison with the corresponding figures for Davos, though the absolute humidity is almost the same in each case. Colorado Springs and Denver both suffer from high winds (nine miles an hour at Colorado Springs, and over six miles at Denver).†

A few words may be said concerning the climate of the coast and of the sea in comparison with inland climates.

The characteristic of ocean climates is a high degree of relative humidity, with consequent low range of temperature. Inland climates, on the other hand, have a comparatively low relative humidity and a wide range of temperature.

The coast climate may be thought to stand midway between the inland and the sea climate. This, however, is not the case, and as a rule the coast climate has a character altogether its own, depending mainly upon the direction of the wind. Generally the land, becoming heated by the sun more quickly than the adjacent water, causes the wind to blow from the sea to the land during the warmer hours of the day—the well-known sea breeze. When the sun goes down, the land loses its heat by radiation more quickly than does the water, and a reverse current blows from the land to the sea—the land breeze.

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† Guide-book details cannot be given here. Much useful additional information will be found in the admirable "Climatotherapy" of Sir Hermann Weber and Dr. Parkes Weber, and, though much less fully, in my own "Handbook of Climatic Treatment."

Besides these regularly alternating currents, the coast land comes under the influence of the general climatic laws which determine the prevalent direction of the wind over the whole district.

The Western Riviera is largely under the influence of cold winds rushing down from the north to take the place of the ascending air warmed over the waters of the Mediterranean. The Mistral, on the Riviera, and the Bora, on the Adriatic, are typical winds of this kind. In alternation with this cold wind, a warm moist wind blows from the south or south-west. Trieste, on the Adriatic, is especially exposed to this unpleasant alternation. When the north wind blows, the climate has an inland or Continental character; when the south wind blows, the climate has the moist character typical of the ocean. Genoa is subject to the same rapid alternation between the mild climate of the sea and the severe climate of the inlands.

Ocean climates in comparison with inland climates, and still more in comparison with mountain climates, being moist with comparatively equable temperature, favour a lower rate of metabolism, and are consequently regarded as sedative or relaxing. Wind, both by its mechanical and by its heat-removing influence, tends to increase metabolism, and therefore antagonises, and may indeed overcome, the sedative action that would probably belong to an equable temperature.

At one time much of the action of mountain climates and also of sea climates was ascribed to greater richness in ozone. Both the alleged fact and the explanation it was supposed to yield have joined the myths of pseudo-science.

The beneficial influence of sea air is sometimes ascribed to the salt it contains. As a matter of fact, the air over sea contains salt only occasionally, when spray from the water is diffused by a strong wind. Thus at Sylt, in the North Sea, after a violent storm, crystals of salt are seen on the leaves of the trees for some miles inland; but after wind of moderate strength (5 of the Beaufort scale, a fresh breeze) salt was not chemically detectable at a distance of 15 mètres from the water-line either at Sylt or at Heligoland.

The winter climate of the United Kingdom, the early spring and late autumn of Colorado, the spring and autumn of Davos and its neighbours, unlike as they appear on first consideration, have one point in common. In all, the demand for heat-production, the demand for tissue-change, is high. The essential point of difference lies in the manner in which the demand is carried into effect. In the moist, sunless climate of England the removal of heat is effected by the combined action of wind and of humidity. In the dry, cold, still air of Davos the removal of heat is effected mainly by radiation. The smallest amount of wind makes the winter climate unendurable. In the dry, sunny climate of Colorado, rather colder than the climate of England, but very much warmer than that of Davos, the removal of heat is effected by radiation and by wind in conjunction.

The comparison of these types of climate, securing essentially the same physiological end by widely different means, is very instructive. In regard to the general influence on metabolism, the chief difference between the three climates depends not so much on the amount as on the regularity or irregularity of the demand; but in regard to the local influence referred to in our Third Law, each climate has a characteristic action, which cannot be neglected in the selection of cases, especially in regard to catarrhal affections of the upper air passages, rheumatic and neuralgic ailments.

CLIMATIC REQUIREMENTS IN DISEASE.

In the preceding sections we have considered chiefly two aspects of the subject: first, the physiological influences of climate; and, next, the response to those influences by the organism according to its equipment or peculiarities. We now have to consider the climatic requirements imposed by various morbid conditions, and first are those morbid states in which the local manifestation is obviously subordinate, such as anæmia, obesity, gout, rheumatism.

Overwork and worry are common forerunners of a breakdown in health. What the fagged-out patient requires is rest—a holiday; and judiciously chosen rest will soon restore the over-taxed machinery to a perfectly sound condition. Yet in this simple type of case an important principle is sometimes forgotten: that all people do not rest in the same way. To one person, idleness; to another person, change of occupation, is rest.

Failure to select a suitable climate may spring from the idea that climate may in itself be bracing, apart from the patient who has to be braced. The only sound course in every case is to estimate the capacity of the circulatory, respiratory, digestive, and muscular systems. If these main functions of animal life are sufficiently vigorous, the patient can spend his holiday with the greatest advantage where the demand for tissue-change is great: in the mountains, on a windy moor, or at the seaside, the details of choice being easily settled by the exercise of a little common-sense.

The type of patient with poor vital powers generally, feeble circulation, small aërating lung capacity, uncertain digestion, will do best where no special tax is thrown on his weak points.

Anæmia.—The selection of a health-resort in cases of anæmia is, as a rule, fairly simple. We have seen that an increase in the number of red corpuscles and in the amount of hæmoglobin in the blood takes place with diminished barometric pressure. At first sight the circumstances would seem to show that every case of anæmia ought to be sent to the mountains; and in the absence of contra-indications this rule may be adopted with advantage. In this connection we must remember that excessive anæmia is in itself a contra-indication.

In view of the general remarks already made, the climatic treatment of anæmia does not call for prolonged discussion. Anæmia is not an independent disease, but a condition secondary to some other morbid condition. It may be associated with direct loss of blood, with a prolonged drain on the system by such diseases as dysentery, tuberculosis, malaria, acute rheumatism, typhoid fever, and many other diseases. The anæmia known as idiopathic or pernicious anæmia has been attributed to a micro-organism. W. Hunter suggests that the majority of these cases are due to a chronic infection which has its starting-point in diseased teeth.

A term applied to such widely different conditions affords little indication for treatment apart from the essential cause at work in individual cases; and the questions that arise as to the choice of climate in the case of persons suffering from anæmia will, to a large extent, be determined by the nature of the primary or allied ailment.

Obesity.—The treatment of obesity is a question of food rather than of climate. Although climate has a marked influence over tissue-change, this action is not uncommonly overbalanced by the accompanying influence on appetite. When a fat person is sent to the mountains or to the seaside in order to quicken the burning-up of the superfluous fat, the result sometimes is that, owing to the increased tissue-change, the patient feels remarkably well, his appetite is much sharpened, and he puts on weight instead of losing it.

The converse observation is also frequently made. The majority of white people in passing from a temperate climate to the Tropics lose weight, the explanation being that although tissue-change is lowered, appetite is diminished to a still greater extent.

The fat person with the needful grit in character to carry out a *régime* not altogether in accordance with appetite can, however, much more readily cut down his weight to its proper dimensions in a cold climate than in a hot climate. Obesity occurs in two widely different classes of case: the robust or plethoric, and the weakly or anæmic. The robust, plethoric type must be dealt with rigorously. For patients of this kind a cold mountain climate or a blustery coast climate is suitable.

The weakly anæmic cases are frequently girls approaching womanhood, and, in later life, flatulent, constipated women who have had many children. In these flabby anæmic cases the anæmia is nearly always secondary either to constipation or to some other form of deficient excretion, the storing up in the body of effete or poisonous organic products. To adopt at once in these cases the line of treatment suitable for the plethoric fat person does harm. The increased tissue-change simply causes the more active storing-up of poisonous matters. The proper line of treatment is to secure the prompt and adequate removal of the products of tissue-change, combining with this action the building-up material called for by the degraded or half-poisoned tissues. In practice these objects are accomplished either by the aloes and iron pill of the Pharmacopœia, or more agreeably by aperient iron waters, as, for example, those of Langenschwalbach, Tarasp, or St. Moritz.

A high altitude is commonly more suitable as an "after-cure" than at the beginning of the treatment. When anæmia is intense the oxygen-carrying elements of the blood are unable to respond to the greater demand made on them in the high mountains. After the constipation or other fundamental cause of the trouble has been removed by the aperient iron waters, and the anæmia somewhat diminished, a quick response is made to the stimulus of the rarefied air, with consequent rapid increase in the number of red corpuscles.

Gout.—When reports from various countries are examined as to the frequency of different diseases, gout is found to be much more prevalent in the cold and temperate regions than in the sub-tropical and tropical. This different prevalence in different climatic zones is not necessarily due to climatic conditions. The people occupying the regions in question differ so widely in regard to food, habitation, dress and customs that these factors may have a considerable influence in causing the disease. Meat, for example, is little eaten in India, where the disease is rare, and forms the principal part of the diet in the colder regions.

No doubt food and the other conditions mentioned have an important influence in the production of the disease, but when full weight is allowed for all these circumstances, climate must be regarded as an effective factor in the occurrence of gout. An hereditary tendency with other predisposing influences, which in a temperate or cold climate would produce an unmistakable attack, would in a hot climate either not cause any ill-effect, or would find expression in some other form, perhaps congestion of the liver or an attack of dysentery.

This consideration affords a valuable guide for treatment. Gouty people, at least those beyond middle life, will as a rule do best in a dry, warm climate.

The general rule laid down does not apply equally to young people. Not infrequently children or adolescents present themselves with a well-marked gouty tendency. The recognition of the gouty state and the adoption of the proper line of treatment will probably stave off the disease, and even prevent its occurrence in later life. The radical defect is the imperfect oxidation and removal of the products of tissue-change. Young people of this kind should be brought up in a climate that calls for the highest degree of metabolism to which their organs can respond, and in which the oscillations in demand are fairly regular. Care has then only to be taken that the supply of food corresponds with the power of the organism to deal with it. These conditions can be secured in a cold, dry, windless climate. For such cases Davos, St. Moritz, Grindelwald, Château d'Oex and the other high Alpine resorts offer unequalled advantages.

Rheumatism and Rheumatoid Conditions.—Under the term rheumatism a great number of conditions essentially different are included. Rheumatism, acute and chronic, and rheumatoid arthritis are now regarded by many as microbic diseases. There is some reason to think that muscular rheumatism may, occasionally at least, belong to the same group. Acute rheumatic fever occurs very frequently in some places, and very infrequently in others; but the distribution seems not to be connected so much with temperature as with humidity, and with those rapid changes that give rise to "chill"—conditions that are found more or less in every part of the world, especially during the spring and autumn months. As to the fact of its occurrence in different regions, the testimony is not always unanimous, even for such a well-known district as the south-west corner of England—Devonshire and Cornwall. According to the statistics quoted by Hirsch, all the rheumatic ailments are extremely prevalent in both counties. Davidson's statistics are to much the same effect as Hirsch's. According to the admirable compilation prepared by the committee of the Royal Medical and Chirurgical Society of London, some places in the district are strikingly rheumatic; others, again, are strikingly free from the disease; while, according to "A Book of the South-West," printed for the British Medical Association meeting at Exeter in 1907, both counties are strikingly free from the disease, the presence of which is said to have been generally over-stated hitherto, the comparative prevalence as shown by the official statistics being as follows:

England and Wales	·084 per 1,000
Devonshire	·069 " "
Cornwall	·079 " "

Thus Cornwall is freer from the disease than England and Wales generally, and Devonshire is even freer than Cornwall.

In Davos, where I have been in practice for twenty-five years, I have seen only one case of acute rheumatic fever, and that case would be more appropriately termed sub-acute. Cantlie, after many years' residence in China, states that he never saw a case of rheumatic fever in hospital there.

Chronic muscular rheumatism, also, is widely distributed; and the conditions that give rise to it are, to some extent, the same—rapid changes in the heat-demand. Thus it is liable especially to occur in places where at one moment there is difficulty in getting rid of the heat produced under the lowest rate of heat-production consistent with the working of the animal machine; while at the next moment there is a rapid removal of heat, calling for the highest rate of output of which the machine is capable. In such a case the body is at first bathed in perspiration, the surface-vessels being relaxed; then with a slight fall of temperature in an atmosphere charged with water-vapour there is a rapid abstraction of heat, without any warning signal to the superficial blood-vessels to contract, and thus to shut off the supply.

From this standpoint we must select for rheumatic cases warm, dry climates with little or no wind. As baths have been found useful in many of these cases, preference must be given to resorts where, in addition to climate, suitable baths are available.

During our summer months Harrogate, Bath and Strathpeffer are much visited by rheumatic patients. The innumerable baths in France, Germany, Austria, Switzerland, and Italy are all considered specially suitable for the cases in question. Amongst the favourites for our countrymen are Aix-les-Bains, in Savoy; Baden-

Baden and Wiesbaden, in Germany; Ragatz, in Switzerland. During the winter months Heluan, about sixteen miles from Cairo, and Hammam R'Irha, about four or five hours from Algiers, afford ideal conditions in regard both to climate and to baths.

The character of the local accommodation and arrangements is apt to change frequently and rapidly in all but the old-established health resorts. As a rule special inquiry should be made before definitely making a choice in any individual case.

Rickets is a disease of defective metabolism, generally connected with deficient sunlight and with lack of fat and lime in the food. In regard to climatic treatment, dryness is of first importance. A warm or a cold climate will be selected according to the child's power of response.

Cheadle's observations are remarkably interesting. Lion cubs at the Zoological Gardens, which had been rickety, lost their rickets and grew up strong and healthy animals simply by virtue of change of diet, ordered by Mr. Bland Sutton.

Diabetes.—Diabetes appears at first sight to be simply a disorder of metabolism, and its remarkable frequency in India has been ascribed to the excessive use of carbohydrates, such as rice. A fact against this theory is that the Jains, who live on exactly the same kind of food, escape the disease; so, it would appear, do Hindu widows. On looking into the frequency of the disease elsewhere, we find that it occurs equally in all types of climate. Neither climate nor food can be considered to have much share in the causation. The most striking point revealed by the comparison of different countries in regard to this disease is the gradually increasing frequency of its occurrence. A consideration of all the circumstances suggests that mental strain—worry, wear and tear, the struggle for life due to "civilisation"—is a most important factor in giving rise to the disease; and this view is really more in harmony with its general nervous relationships than is the view that ascribes the causation to disordered metabolism.

In the climatic treatment of the disease no difficulty arises. Climate has by itself no action whatever, but a change of climate may be of use in so far as it conduces to the greater physical or mental comfort of the patient. Certain spas have a reputation in cases of diabetes: Carlsbad, for example, Wiesbaden, Marienbad, Vichy. Exact observation has shown that the waters of these spas are absolutely without beneficial effect, except possibly in so far as the warm temperature at which they are usually taken may relax high arterial tension. Whatever benefit comes from a visit to a health resort must be ascribed partly to the mental comfort due to the removal of worry, partly due to the suitable dieting—for which the resorts in question make special arrangements, which cannot ordinarily be obtained at other health resorts, or, usually, even in a private house.

One or two precautions must always be borne in mind concerning diabetic patients. Only the mildest cases should be allowed to undertake a long journey or journey involving fatigue or anxiety. In cases apparently slight, diabetic coma may be caused without warning by fatigue, worry, or chill.

Diseases of the Heart and Circulatory System.—Galen observed that the pulse is slower, harder, and stronger in summer than in winter, and his observations correspond with the result furnished by the instruments of the modern physiologist—that cold raises arterial tension. The application of an ice-bag to the heart has in many conditions a marvellous action in slowing and strengthening the beat.

One of the questions most frequently put to the medical man in this connection is, whether such and such a person could safely go to the mountains. Some physicians adopt a safe line by forbidding the mountains in every case where any cardiac trouble, functional or organic, can be detected. This plan, though safe for the practitioner, is hardly fair to the patient. Some cardiac troubles are benefited, some injured by the mountains. Happily, the points on which the decision turns are very simple, and within the grasp of any ordinary medical man.

At a high altitude the heart is called on to do more work than in the adjacent lowlands; and this for two reasons: in the rarefied air the supply of oxygen is less, and in the colder air more oxygen is consumed. The question whether the heart will be all the better for having to do this extra amount of work, or whether it will be taxed beyond its capacity, can be determined practically without any very refined diagnostic methods. The ordinary medical practitioner has no difficulty in saying, in the case of organic heart lesions, whether the disease is fully compensated or not. If the disease is not fully compensated, high altitudes must be avoided; and steps should be taken to secure adjustment of the heart-muscle to the work it is called upon to do. For this purpose a dry, moderately warm climate in a fairly sheltered and not very hilly country affords the patient the best environment for the damaged organ.

Persons with fully compensated organic heart disease can perfectly well visit high altitudes, but should be cautioned against excessive exercise, especially soon after arrival.

Cardiac weakness due to general ill-health is likely to benefit in the mountains, provided a mountain climate is otherwise suitable.

Arterio-sclerosis and other forms of vascular degeneration are exposed to a greater amount of strain in an excessively cold climate than in a temperate or warm climate.

Digestive System.—Digestion is likely to be improved or impaired, according as the rate of tissue-change called for by the conditions of the new climate correspond, or not, to the patient's power of response. The appetite and all the digestive functions o a person with low general vitality and feeble circulation will be greatly improved by removal from a cold to a temperate or warm climate—for example, from the High Alps in winter to the Riviera or Egypt. Equally, the robust young man who complains o lassitude, poor appetite and indigestion on the Riviera or in Egyp regains strength, appetite, and digestion on coming up to the High Alps.

The chief caution to bear in mind is the application of our Third Law. Chronic intestinal catarrhs do badly in all extreme climates Those who have had dysentery are very apt to have renewed trouble from excessive cold; while in warm climates there is a tendency to diarrhœa—probably not from the direct effect of the temperature, but owing to the changes which food so readily undergoes in hot weather.

The action of temperature in bringing on diarrhœa is obviously due, not to a general act on nutrition, but to a reflex action starting from the abdominal surface. That this is the case can readily be gathered from the effect of a woollen abdominal belt. Most old Indians who have suffered from dysentery can by wearing such a belt keep free, or comparatively free, from recurrent attacks, to which they are subject if they wear no belt.

Hyperæmia of the abdominal organs is one of the most striking points in the pathology of the Tropics, both in regard to Europeans and to native races. This hyperæmia must to some extent be ascribed to "chill." Ordinarily the surface-vessels are dilated, and the skin is inclined to be moist. Cold constricts the surface-vessels, and thus tends to cause internal engorgement. The more ready decomposition of food in a warm climate just mentioned aids in making abdominal disorders the most frequent source of ill-health in hot climates, especially in climates damp as well as hot. Typhoid fever, though much more under control than dysentery, has not yet by any means been stamped out. Hill diarrhœa is another intestinal disease that helps to swell the mortality, especially of Europeans, in India and Burma.

Nervous Ailments.—In regard to nervous ailments, general principles afford the chief guide; and the same caution has to be attended to: that the extremes of heat and of cold are alike badly tolerated. We have already seen that in order to retain good health in the Tropics a sound nervous system is indispensable. The extremes of cold are not so likely to cause exhaustion of the higher central nervous system; but have a greater tendency to affect the peripheral nerves. Bell's paralysis, and many forms of neuralgia, are traceable either to cold or to those rapid alternations in heat-demand that come under the general heading "chill." As such conditions are met with, not merely in cold countries, but in warm climates subject to rapid changes in relative humidity and in wind, these peripheral nervous diseases are fairly widely distributed throughout every latitude. An additional cause for their prevalence in hot countries is the occurrence of malaria.

While no climate has a direct action on the ailments in question, the selection of climate is not a matter of indifference. The first point to consider is the desirability of an increased or of a diminished rate of tissue-change. The next point is to avoid selecting a climate that might have an undesirable local effect on the nerves or blood-vessels.

A practical point to remember is that the seashore is by many people felt to be "exciting," even though the place is generally felt to be "relaxing." As there is a good deal of idiosyncrasy in this matter, the individual peculiarities of the patient should be enquired into. Many people who suffer from insomnia within a few hundred yards of the sea sleep well a mile to two inland.

Ex-ophthalmic Goitre (Graves's Disease, Basedow's Disease).—In regard to Graves's disease I may quote what I said elsewhere.* "As regards climatic influence a fairly bracing place is most suitable. These patients, as a rule, do not bear heat well. Suffering from excessive metabolism, they have difficulty in getting rid of their heat, even by means of the moist warm skin from which they commonly suffer, and by which radiation and evaporation are increased. There is some divergence of opinion as to whether the seaside, an inland district, or a high altitude affords the most desirable residence. The fact is that patients do well in any one of the three, provided the conditions are otherwise favourable. But there seems to be a certain amount of caprice with this disease, as with asthma and with neurasthenia, in its response to climatic influence. Hence divergent opinions. Kruse praises the air of the North Sea. Möbius, on the contrary, finds that the North Sea often has an unfavourable influence, while the East Sea is beneficial. Veraguth, Bruns, and many others have seen excellent results in the high mountains. This also has been my own experience, though not invariably. Each case must be taken on its merits. Schmecks (Tátrafüred, Hohe Tátra, Hungary), 3,400 feet above sea-level, has a special reputation in Basedow's disease. A sea voyage, from which some observers have seen excellent results, can be advised only where the usual discomforts of steamer travelling will not come into play."

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* "Handbook of Climatic Treatment," p. 507.

Tuberculosis.—Tuberculosis in all its chronic manifestations, whether affecting lungs, bones, glands or serous membranes, is largely influenced for good or for evil by climate. This element in treatment is not infrequently overlooked by extremely able men, otherwise thoroughly acquainted with the disease, who have not grasped the significance of the physiological action of climate. Before the subject was understood enthusiasts sang the praises of one health resort or the other, ascribing to entirely different climatic stations specific virtues in the treatment of the disease. The only sound view is that climate may favourably influence the disease in two ways: first, by conducing to the highest level of nutrition; and, secondly, by supplying the local conditions most favourable to enable the diseased tissues to regain their normal health. Thus in every case two problems must be considered by the physician: first, the general condition of the patient, his value as an animal machine; and, secondly, the local manifestation of the disease, according as it affects bones, glands or other organs.

The first point has already been fully considered in connection with our Second Law, the Law of Individual Response. The second point also was touched on in connection with the Third Law, the Law of Local Requirement. Only a few additional remarks, therefore, are called for now. In view of the importance of the subject, however, some repetition may be allowed.

Pulmonary tuberculosis in young subjects as a rule does best in cold, dry, windless climates, such as that of the High Alpine stations.

If the case is complicated by much bronchial catarrh, the same type of climate is to be chosen, unless the catarrhal condition is of an excessively irritable type.

Precisely the same physical condition of lungs, but without bronchial complication, occurring not in the young subject but in a person beyond middle life, might possibly do best in the mountains, but probably would find the Riviera or Egypt more suitable, and if a bronchial complication were present this certainly would be the case.

A laryngeal ulcer of sluggish or indolent type, where the surrounding mucous membrane is not irritable, is not a contra-indication for the mountains. An irritable mucous membrane of the larynx or trachea, whether ulcerated or not, contra-indicates an excessively cold dry climate. Parenthetically I may add that when patients suffering from these conditions find themselves in the mountains, the open-air treatment is likely to make them much worse.

Hæmorrhagic cases are, as a rule, better at a little distance inland, rather than very close to the sea. The small hæmorrhages of early pulmonary tuberculosis, of congestive origin, do not contra-indicate a high altitude. Where there is reason to think, however, that the hæmorrhage is due to a ruptured vessel in a cavity a high altitude will be avoided.

Cases complicated with intestinal tuberculosis are best off in England. Apart from the food question, the cold of the mountains and the heat of the southern stations are alike prejudicial.

One general caution must be borne in mind. When the disease is active, the patient seriously ill or with much fever, absolute rest is indispensable, and a long journey may be followed by serious results.

Tuberculosis of glands or bones commonly does best at a "bracing" or blustery seaside resort, such as Margate or Berck-Plage.

Catarrh of the Upper Air Passages.—The same principles as in the preceding case will guide us here. In regard to the general condition of the patient we must bear in mind that all these catarrhal affections are not infrequently secondary to gout, syphilis, tuberculosis, or other ailment. In such cases the primary disease must be dealt with.

Hypertrophic nasal catarrh does best in a dry climate: one chief reason why asthma of nasal origin is usually benefited by the cold dry air of the mountains and made worse by the moist air of the seaside. The pharyngeal mucous membrane, if irritable, is intolerant of excessively dry cold air, but is soothed by moderately warm air of only medium dryness. This rule holds good for the larger bronchial tubes.

Diseases of the Kidney.—In diseases of the kidney a dry, warm climate should be selected. The Riviera and Egypt are suitable for the winter months, and for the summer months a dry sheltered inland district may be chosen.

CONCLUSION.

To enumerate every morbid condition and its climatic relationships would involve much needless repetition; and the mass of details would tend rather to conceal than to display the simple guiding principles, the three Laws of Medical Climatology. These Laws, kept steadily in view, will enable any medical man to investigate a case in reference to climate, and to form an opinion subject to a very small margin of error. Some margin must be allowed; for even the best-regulated mental scales cannot be regarded as equal in precision to the chemist's balance.

WILLIAM R. HUGGARD.

ELECTRO-THERAPEUTICS.

The applications of electricity in medical work are so numerous that an entire volume could be filled by the detailed consideration of them, and even a list of the complaints in which electrical treatment has been used would occupy a considerable amount of space.

In this article a general review of the principles of electro-therapeutics will be given, but readers are necessarily referred to the special works on the subject for more detailed information.

A very large part of electrical treatment has to do with the use of electrical currents for purposes of stimulation. The stimulating effects of electricity can be observed not only in nerve and muscle, but in all forms of living tissue; even in some of the so-called sedative effects of electricity, as for instance in applications for the relief of pain, the real action is probably a stimulation influencing the capillary circulation, and so having the effect of relieving a congestion to which the pain is due.

It is a general principle that for stimulation of protoplasm a varying current is more effectual than one which does not vary, and we find that the most extensively used electrical apparatus is the induction coil, which of itself gives out a rapidly varying current, the so-called faradic current.

Another part of electrical treatment has to do with the electrolytic action of currents either for destructive purposes by the electric needle in the treatment of moles, warts, nævus, removal of hair, etc., or for the electrical introduction of drugs as a means for local medication. This branch of medical electricity is dealt with under the heading of Ionic Medication (*see* p. 180), and requires steady continuous currents.

Electricity is also used for the production of Röntgen rays, for the heating of galvano-cauteries, for the illumination of exploring lamps, for the energising of electro-magnets, and for the production of heat and of concentrated light for therapeutic purposes.

The use of electrical currents for diagnosis in nervous affections is also a very important branch of medical electricity.

The apparatus used in electro-therapeutics is extraordinarily varied; and the electricity employed may be drawn either from batteries or accumulators or from the electric lighting mains, provided that suitable apparatus is adopted. A study of an electrical instrument maker's catalogue will give much useful information as to the various forms of apparatus for these different conditions.

A knowledge of the units of measurement—the volt, the ohm and the ampère—cannot be dispensed with. Here it must suffice to mention that the volt is the unit in which electrical pressure or electromotive force is expressed, while the ampère is the unit for the magnitude or quantity of current, and the ohm is used to express the resistance of the circuit along which the current is driven by the electromotive force acting on the circuit. It is but rarely that a current of an ampère traverses the body of a patient, and indeed if we except the special case of high frequency currents the passage of an ampère through the body would probably be fatal to the person traversed by such a current. Accordingly in medical practice the current is usually limited to a few thousandths of an ampère, and for convenience the thousandth part of an ampère is called a milliampère. For instance, the fraction 0·01 of an ampère is spoken of as 10 milliampères.

Electrical applications may be divided into two groups, viz., general electrisation, in which the currents are applied to the body as a whole, and localised electrisation, in which currents are applied locally to some particular organ or region of the body. General electrisation is used for general morbid conditions, as in the treatment of various forms of defective nutrition, such as debility, anæmia, chlorosis, rickets, after influenza, in neurasthenic states, in the nervous disturbances of the menopause, in general toxic neuritis from diphtheria and other specific fevers, and from alcohol, arsenic and lead, and in certain forms of mental failure, particularly in those in which the general nutrition is defective. In chronic gout and rheumatism general electrisation is also useful, and in some glycosuric states a decrease of the quantity of sugar excreted in the urine has been observed after this kind of treatment.

The modes of general electrisation are the electric bath, high frequency applications, and statical treatment, each of which have their special advantages or conveniences.

The Electric Bath.—Here the patient lies in a full length bath of warm water through which a current of electricity is passed between electrodes placed at the two ends of the bath. An interrupted current such as that of the induction coil, or the current of the alternating mains, or of an alternating dynamo (sinusoidal current) should be used. To secure the best results it is well to employ a device for giving rhythmical variations of the strength of current, causing it to rise and fall at the rate of about fifteen times a minute.

The sinusoidal or dynamo current is the best to use, as it is superior to the current of an induction coil in having greater smoothness and regularity, the rise and fall of current being even and gradual in the case of the dynamo, and uneven and abrupt in the case of the induction coil. The current for the electric bath must permit of even and careful regulation, and if the electric lighting mains are used all necessary safeguards against risk from excessive current must be rigorously adopted.

The effect of the electric bath is shown by increased appetite and colour and by a gain in weight of the patient. The applications should be made on alternate days, the duration of the bath being ten or twelve minutes, and the strength of current arranged so as to be strongly felt, but insufficient to tetanise the muscles of the hands and feet.

High Frequency Treatment consists in the application to the patient of oscillatory currents of high potential. Usually they are given on a special "condenser" couch upon which the patient lies, with his body in contact with one pole of the apparatus, while the other pole is attached to a large sheet of metal underneath the mattress, which serves as an insulator between the two poles of the apparatus. During an application a large current of 250 to 500 milliampères or even more surges in and out of the patient, but the rate of oscillation is so high (about a million per second) that in spite of the largeness of the current no painful shock or muscular contraction is caused. The chief effect noticed is a vasomotor one with a sense of warmth around the point of attachment of the electrode, an increase in the volume of the pulse, increased respiratory exchanges and a general improvement in the condition of the patient. The current may enter the patient by handles held in the hands or by a moistened pad electrode attached to any desired part of the body. The latter is the best when high frequency currents are used for the relief of local pains or congestion, as in perineuritis, sciatica, etc., but the former is often used when a general electrisation by high frequency currents is the object aimed at. In all high frequency applications care must be taken to keep the conducting wires away from contact with the patient's skin or clothes, otherwise strong sparks may pass and produce severe superficial burns. The applications when properly applied should cause no burning or pricking sensations at all. Care is necessary when applying high frequency to patients with heart disease, for the peripheral vasomotor changes may influence the heart's action unfavourably.

Statical Treatment is carried out by an electrostatic machine with revolving glass or ebonite plates which generate electricity of very high voltage, but only yield minute quantities of current. The patient is insulated upon a glass legged platform and connected to one pole of the machine. He acquires a high electric charge of many thousand volts, and if the other pole of the machine is approached to the patient a discharge takes place in the form of an aigrette or brush discharge, or of strong sparks, according to the character of the pole (knob or point) which is used. The brush discharge to the scalp produces an agreeable sensation, and if applied to the back through the clothing produces a not unpleasant pricking sensation something like that of a fine douche or "needle bath" of hot water. Static treatment raises the blood pressure and produces good general tonic effects in the elderly, the infirm and the anæmic. It is liked by these patients, and is disliked by those of plethoric habit of body and those with a high blood pressure. Static treatment is not much used in this country, as the apparatus is cumbersome and needs skill and knowledge to keep the machine in good working order.

The static brush discharge applied to the back and loins is useful in many cases of scanty or painful menstruation. It is quite probable that this effect may be a result of the rise in general blood pressure produced by the treatment.

Localised Electrisation.—When electricity is applied locally for medical purposes the current of electricity is conveyed from the battery or other source of current to the patient by means of wires terminating in electrodes. The electrodes most often used are metal plates or discs covered with some absorbent material, such as chamois leather or cotton fabric, which is moistened with warm saline solution before use to render it conducting. The skin of the region to be treated must also be moistened in the same way, for the comfort of a patient during electrical testing or treatment will be the greater the more carefully this preliminary moistening is carried out. Care must always be taken in the regulation of the strength of the current, in order to avoid unpleasant shocks to the patient. It is a useful rule for the operator to test the current upon himself before applying it to the patient.

The simplest forms of electrical currents used in medicine are the currents of the medical induction coil, or "faradic" currents, and the currents from a battery of galvanic cells, or "galvanic" current.

Medical batteries are made in the form of a box holding the apparatus for both these currents, and such medical batteries can be employed for a number of useful applications.

Suppose that the case for treatment is one of paralysis of the extensor muscles of the forearm from an injury to the musculo-spiral nerve, and that the application is to be one of the induction coil current. The wires are attached to the battery and to the electrodes. One electrode, usually known as the "indifferent" electrode, should be a metal plate, prepared as already described, and applied to the nape of the neck or held against the chest wall or to the upper part of the arm, as may be convenient. The other, or "active" electrode, should be a metal disc, 2, 3 or 4 inches in diameter, covered and moistened, and provided with a handle for ease of manipulation. The induction coil is then set in action, and adjusted for very weak currents, and the disc electrode is slowly moved to and fro over the moistened extensor surface of the forearm. The strength of current is then gradually increased until it becomes as strong as the patient can bear without undue discomfort. This manipulation is continued for about ten minutes, and may be repeated daily. If the "galvanic current" is to be used the same procedure is carried out, only the attachments of the wires are to the terminals of the "galvanic" circuit. The regulation of the current is attended to in the same cautious manner, and it presents this advantage over the "faradic" current that the magnitude of the current passing through the patient can be measured by means of a galvanometer, with which a proper medical battery is always fitted. A current ranging between 5 and 10 milliampères will be sufficient for the case we are considering.

Most forms of electrical application to the surface of the body are carried out as here described, with such modifications in the sizes of the electrodes and the strength of the current as may seem required by the special circumstances of the case. For example, in applications to the face currents of less strength will be used than in applications to the arms or to the legs.

For special applications to the orifices of the body special electrodes are needed. These are made by the instrument makers and are figured in the catalogues, but they are only required in occasional cases.

When electricity is to be used for the testing of the muscles, one electrode (indifferent) is arranged, as before, near the upper part of the limb, but a "testing" electrode is used for the active electrode. It consists of a small disc of metal held in a handle, as already described, but with a key in the handle for completing the electrical circuit at will. The testing electrode is then applied to the various muscles concerned, the key is closed momentarily, and the effect upon the muscle is observed. If the contractions produced correspond with those seen in healthy muscles, the muscles are assumed to be normal. The phenomena of the normal muscular contractions are as follows: The application of the interrupted current produces a tetanus of the muscle which lasts throughout the time of the passage of the current, and the application of the galvanic current produces a momentary twitch in the muscle at the instant of closing the circuit only. When the nerve supplying the muscle is altered by division or injury or by disease either in some part of its course or in its motor nucleus in the anterior cornu of the cord, these normal reactions disappear. In well-marked cases the application of the interrupted current no longer causes any response at all, while the galvanic current gives a slow contraction at the moment of closure which is quite unlike the sudden twitch of a normal muscle, and is therefore easily recognised. This alteration in the responses to testing is called the reaction of degeneration, and is constantly of service in the investigation of nervous disease.

Its presence in a muscle implies serious disease in the nerve trunk supplying it, or in the grey nucleus in the anterior column of the cord from which the nerve arises. At the same time, it must not be taken to imply an incurable condition, as the term "reaction of degeneration" might seem to imply.

The testing of the muscles supplies the best method of determining death, for the muscular response to electrical currents disappears within an hour or two after death has occurred.

In affections of the nervous system electricity has proved its value both for diagnosis and for treatment. As a mode of treatment for peripheral paralysis of various kinds, whether from injury or disease, its utility is undoubted, and it serves to hasten recovery in all such cases provided that there is nothing in the nature of the case to make recovery impossible. If the paralysis is due to a divided nerve trunk, naturally steps must be taken to remedy this before electrical treatment can intervene.

In diseases of the spinal cord the uses of electricity are less evident. In infantile paralysis the muscles which have lost all their motor nerve cells are beyond the reach of treatment, but more often a case of infantile paralysis presents some partially damaged muscles, and the restoration of these to the best degree of functional activity is a favourable field for electrical treatment.

In the degenerations of the spinal cord electricity, so far as we know at present, is of little use. Cases of tabes are met with from time to time, which respond favourably to electrical treatment for a while, and show distinct amelioration of this or that symptom, but that is all that can be said.

In diseases of the brain hemiplegia may be mentioned as a condition for which electricity is of service. The regular stimulation of the paralysed limbs seems to have a favourable influence upon the rate of recovery of hemiplegic cases, provided, of course, that the damage causing the hemiplegia has not been too severe.

Other affections of the nervous system for which electricity is useful are the functional paralyses and anæsthesiæ, aphonia, chorea in its later stages, neuralgias and painful perineuritis. Of these latter conditions sciatica is one of the most important, and electricity is frequently used for its relief. Continuous currents must be used, with large electrodes placed along the line of the nerve, and large currents. The results are better if the treatment is given with the negative pads moistened with salicylate of soda, as indicated in the article on Ionic Medication, p. 180. The effects of the current in this case are due partly to the introduction of the drug and partly to the effect of the current in relieving the congestion or inflammation of the sheath of the sciatic nerve. Similar methods are useful in painful brachial neuritis.

The neuralgic pains that follow herpes zoster are not very favourably influenced by electrical applications as a rule, though there are exceptions.

In disorders of the circulatory system we may mention the treatment of chilblains as a condition which is very greatly benefited by electrical treatment. The best method of giving it is by means of two arm baths or foot baths with warm water. The interrupted current of the induction coil is suitable, and the sinusoidal current of the alternating mains after reduction to a low voltage by transformer and resistance is even better, if it can be obtained.

One electrode is placed in each of the baths, and one hand or one foot also, and the path of the current is then up one limb and down the other. An application of this kind repeated daily for a week or two will usually suffice to drive away any chilblains, and indeed will often prevent any return for a considerable time. Raynaud's disease is often much relieved by the same treatment.

The swelling and pain of a recent sprain is very remarkably improved by electrical applications. Sometimes a single application will remove the pain entirely. The effect here is mainly a vascular one, and the pain is relieved by the removal of congestion. It may be taken as a general rule that for the relief of pain the continuous current is usually better than the interrupted. Th latter is apt to be too irritating for parts which are tender an inflamed.

In digestive disorders electricity applied to the abdomen may be used for constipation, also in the vomiting of pregnancy. Both forms, interrupted and continuous, should be used, the former acts most upon the muscles of the abdominal wall and the latter upon the intestinal muscle. High frequency applications with the electrode at the pit of the stomach are useful in atonic dyspepsia. In true nocturnal incontinence of urine the employment of interrupted currents with the electrodes applied to the lumbar spine and to the perineum are quite satisfactory in their effect.

Many skin diseases are benefited by the applications of high frequency currents, and the treatment of these is carried out in a special way. The patient lies on the condenser couch, as already described, but the wire from the apparatus is attached to a special hollow glass tube electrode exhausted to a partial vacuum instead of the usual moistened pad. When this electrode is moved over the affected surface of the skin showers of minute sparks pass to it from the outer surface of the glass and set up a mild counter-irritation, which is probably assisted by the production of ozone and of nitric oxides and exercises a useful effect.

H. LEWIS JONES.

HYDROLOGY.

INCLUDING AN INDEX OF SPAS.

SYN.—Balneology, "Spa Treatment": Fr., *Hydrologie*, *Crênothérapie* Germ., *Balneologie*, *Crounotherapy*; Ital., *Idrologia*; Span., *Hydrologia Medica*. (From ὕδωρ, water; κρήνη, source; *balneum*, a bath.)

Definition.—Medical Hydrology* is the science of treatment by means of waters, vapours and mineral or organic deposits in connection with waters, both by internal administration and in the form of baths and applications.

MEDICINAL USE OF WATER.

Water is the medium of primitive forms of life and remains a vital necessity for all forms. In acute illness we return to the condition when only liquids are admissible. None but aqueous foods are digestible in conditions of weakness and debility, in infancy or convalescence, and after long fasts or extreme fatigue. On the other hand, there are chronic states of hydræmia and heart weakness, especially in obese subjects, in which the watery medium is in excess and the intake of water should be strictly limited. Again, if taken in any quantity together with food when the stomach is dilated, water dilutes the gastric juice and aggravates the existing dyspepsia and dilatation. Copious draughts should not be given without due regard being had to the power of elimination. When absorption is more active than elimination, a sudden intake of water may cause temporary plethora, with increase of blood pressure and even cerebral hæmorrhage. These considerations show that in the case of invalids the medicinal use of waters should be carefully graduated in respect to quantity and time of administration. An increased intake of water is necessary in acute and pyrexial diseases and in many chronic toxæmias. It is also indicated in congestive and dyspeptic conditions, brought about by an excess of over-stimulating food, with which a deficiency of dilution is usually associated. The diluent action of water to a large extent accounts for the benefit derived by this class of dyspeptics at most of the mineral spas. The point of thermal indifference for the stomach is from 97° to 100° F. Colder waters increase the motility of the stomach and bowels, and hasten the passage of their contents, and so promote defecation. The effect of cold drinks, like cold applications and cold enemata, is to diminish the temperature of the body, to slow the pulse and to increase arterial blood pressure. Hot drinks, on the other hand, diminish gastric motility and delay the passage of contents. The passage of water from the stomach is favoured by walking exercise. Taken in the proper manner and when the stomach is empty, water, hot or cold, is rapidly absorbed and passes into the portal circulation. The taking of water promotes change of substance, absorption of fat and lixiviation of the tissues. It is therefore useful in obesity, in constipation, in renal and hepatic lithiasis as well as in most conditions of toxæmia.

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* The nomenclature of this subject is at present in a state of some uncertainty and confusion. In the latter half of the nineteenth century two movements received a powerful impetus: (1) The action of water upon the body and its use in therapeutics, which had been generally known in modern times, owing to the writings of Currie (1797), were for the first time subjected to scientific enquiry and analysis. The work of Winternitz and his followers has done much to define the physiological actions and effects of fresh water, used internally and externally, at different temperatures and in various applications. To all such treatment by means of fresh water the name *Hydrotherapeutics* or *Hydrotherapy* has since by common consent been applied. (2) A similar movement of scientific analysis has been vigorously prosecuted with regard to the properties and uses of mineral waters and baths. In this field the work of many observers in many countries has already borne good fruit. The art of medical treatment by means of all kinds of waters and baths, which necessarily includes the operation of pure water, is being slowly built up on a scientific basis. To this science the name of Hydrology or Medical Hydrology has been more and more applied on the Continent of Europe, whilst the older and narrower word Balneology is still used in England and Germany in a restricted sense, as applied to *mineral* waters and baths. Many friends having authority in matters of medical nomenclature have agreed with the writer that it is more fitting to the natural order of things that *one name* should include the whole subject. It is proposed to follow the Latin races in adopting the designation Hydrology to include the doctrine of the properties and uses of mineral waters (in their multiple forms), and also the doctrine of the medical use of fresh water. The present article is not concerned with the hydrological treatment of acute disease, which is dealt with elsewhere.

GENERAL ACTION OF BATHS.

Baths take effect directly upon the skin, and indirectly upon all other parts of the body. Cutaneous absorption in the bath is a negligible factor, excepting in the case of volatile constituents like sulphuretted hydrogen. The action of baths consists in the application of heat and moisture and different forms of mechanical and chemical energy to the surface of the body. The thermal effects of baths may be briefly summarised as follows: Cool baths increase the loss and production of heat. Baths at about 93° F., the average temperature of the skin in healthy persons, produce no appreciable change either in heat production or loss, and this is therefore called the *point of thermal indifference for water.* Baths at a temperature above 93° F. cause an accumulation of heat in the body by checking its normal loss. When the loss of heat is entirely prevented, the body temperature may rise as much as 4½ degrees in half an hour. Hot immersion and vapour baths rapidly augment the bodily heat and produce an artificial pyrexia. Applications of cold increase the combustion of fat, whilst thermal baths tend to stimulate the dissociation of nitrogenous tissues, with an increased excretion of urea.

In cold and cool baths a protective contraction of the peripheral vessels takes place, with increase of vasomotor tone. The blood pressure rises, and the heart's action is increased and slowed. Increased tonus and diminished blood supply in the superficial parts are accompanied by a corresponding diminution of tone and increase of blood supply in the viscera. The circulation is in a sense short-circuited. Baths at a temperature between 80° and 93° F. may be described as *sub-thermal.* Baths of this range, especially when combined with various forms of cutaneous stimulation, are of much value in cardio-vascular disorders (*vide infra*). Their general effect is sedative. They withdraw heat to a moderate extent and slow the pulse, and by reducing peripheral tone invite the blood into the extremities and skin. Thermal and hyper-thermal baths freely open the surface arterial system, accelerate the pulse, and, after an initial rise, diminish the blood pressure. The subsequent reaction may continue for many hours. After a course of thermal baths there may be in sensitive subjects a marked debility, which continues for many weeks or months. Cold applications after heat may prevent this late reaction.

The changes that take place, first in the circulation and secondarily in the body at large, as the result of cold applications, constitute the *reaction to cold.* The immediate closure of the surface vessels is a reflex action, protecting the body from dangerous loss of heat. After a variable time the reaction sets in. A rapid increase of heat production is balanced by a return of circulation to the skin, as the first chilliness is succeeded by a sensation of warmth. The reaction to cold is a matter of great importance in the administration of baths. In health it is proportional to the initial stimulus of the thermic nerves, but in disease its character depends on the integrity or otherwise of the nervous and circulatory functions. A rapid and adequate reaction is looked for in the treatment of chronic disease by baths. Its absence or insufficiency at once places the physician upon his guard.

GENERAL CHARACTERS OF MINERAL SPRINGS.

Mineralisation.—Springs of a superficial origin derive their constituents from the rocks through which they percolate, and naturally contain the more or less soluble elements found in the sedimentary strata—the carbonates and sulphates of calcium and magnesium, the chlorides, nitrates and dissolved oxygen. The presence of carbonic acid gas, derived from the soil, assists the solution of earthy salts. The nature of the beds through which the water passes—gypsum, rock-salt, mountain limestone, chalk, etc., determines the mineralisation of particular sources. On the other hand, waters (usually thermal) of an igneous or volcanic origin, contain a different group of elements. The total mineralisation is usually insignificant in comparison with that of many cold springs, and appears to be singularly out of proportion to the alleged active properties of the springs. The elements found in these waters include arsenic, phosphorus, boron, silica, iodine, bromine, fluorine, and sulphide and carbonate of soda, and there is often present a considerable quantity of nitrogen gas and its congeners argon, helium, etc.

Doctrine of Ions.—As bearing upon the properties of mineral waters, particularly those of slight mineralisation, the doctrine of ions may be referred to here. It is believed that the saline molecules dissolved in a mineral water are present to a large extent not in their molecular form, but dissociated in the form of ions. The dissociation of saline molecules into ions, for example sodium chloride into a sodium and a chlorine ion, was at first regarded as the result of electrolytic decomposition. It is now believed that the mere *solution* of a salt results in the liberation of ions, and that the passage of an electric current through the solution only carries them to their appropriate poles. Investigations of the electric conductivity of saline solutions, and of their freezing point (which both depend on the amount of saline matter and of free ions contained in the solution) have led to the conclusion that all such solutions contain a proportion of their saline constituents in the dissociated state, as ions. The basic ions, cations, have a positive electric charge, whilst the acid ions, anions, are negatively charged. The electric conductivity of a solution is the measure of the free ions present in it. It is also known that the number of ions present is inversely proportional to the concentration of the solution, and that when the dilution passes a certain point the ionisation of the saline may be regarded as complete.

These facts have an important bearing both on the constitution and actions of mineral waters. In accordance with them, it is now usual to represent the results of an analysis of a given spring in ions, stating the exact amounts both of negative and positive ions that make up the more or less hypothetical grouping of salts. There is reason to believe that the dissociated and electrically charged ion has quite other properties and activities than those belonging to the element in the combined state. In the case of a mineral spring, the dissociated state of its active principles introduces a new element into the theory of its action. It may be found to throw light on some curious differences between the action of natural water and that of similar waters artificially produced. It may also suggest an explanation for the medicinal effect of ingredients in the spring of which the proportion seems insignificant according to chemical analysis.

Tonicity of Mineral Waters.—Intimately connected with the presence of saline matter, is the *osmotic pressure* or *tonicity* of mineral waters. According to the laws of diffusion, every solution has an osmotic pressure proportional to the molecular weight of the substance in solution. The osmotic pressure is the force of osmosis or diffusion through an organic membrane. It varies in all solutions with the degree of concentration, and in the case of salines is exactly proportional to the number of molecules and ions of the contained salts.

The tonicity of a mineral water is its osmotic relation to the blood and body fluids. As a therapeutic agent viewed in relation with the blood, a mineral water may be one of three kinds. (1) The *hypotonic* waters have a low osmotic pressure; (2) *isotonic* waters are equal in pressure; and (3) *hypertonic* waters have an osmotic pressure in excess of the blood. There are many valuable waters in all these classes. Most waters of low mineralisation are hypotonic. There is an important class of waters, some hot and some cold, that are practically isotonic, whilst all the purgative waters are hypertonic. It will be obvious that the tonicity of waters is an important factor in their therapeutic effect.

Radio-Activity.—Many spa waters, particularly those of the thermal class that contain nitrogen and its various congeners, show a considerable degree of radio-activity, due to the presence of radium emanations in the contained gases. Such waters manifest most activity when fresh from the source, and lose it when exposed to the air. It would seem that this property is imparted to some extent to the atmosphere in the vicinity of the spring. Radio-activity has been demonstrated in the vapour of the bath-room at Wiesbaden and elsewhere. What precisely are the qualities which are imparted to a water by its radio-activity has yet to be determined by observation and experiment. An intensive effect in rheumatic conditions has been observed by some. An increased urate-dissolving power has been also advanced. Thus it is stated that as a result of drinking the water of Baden-Baden the excretion of urine is increased by 34 per cent., and that of urates by 14 per cent. more than is the case after drinking the same amount of ordinary water heated to the same temperature. It is certainly notable that some thermal baths of very low mineralisation, like that of Gastein, which have been long regarded as possessing undefined but active properties, have been shown to be particularly rich in radium emanations.

KINDS OF MINERAL WATERS AND THEIR USES.

Thermal Waters.—Mineral waters have been classified as cold or thermal. Thermal waters are conveniently described according to the temperature of the source, viz., *hypothermal*, from 68° to 98° F., and *hyperthermal*, from 98° F. upwards. In England there are several such springs, of which the two chief, Bath (104° to 120° F.) and Buxton (82° F.), were known to the Romans. The others are Matlock (68° F.) and Bakewell (60° F.), in Derbyshire, and Clifton (73° F.); in Somerset. Ireland possesses one such water, Mallow, in Co. Cork, formerly much resorted to. There are many and varied thermal stations in France, some of which were highly esteemed during the Roman occupation. They are distributed in the Pyrenees and Vosges Mountains, and in the volcanic district of the Auvergne, and a few are met with in the Alps. Thermal waters are also found in the Rhine district of Germany, in the Black Forest, in Bohemia, Austria and Italy, and in Algiers. They abound in the Caucasus, and in Iceland the eruptive waters (geysers) attain a temperature above that of boiling water. Kamschatka, where thirteen volcanoes are still active, is said to be richer in thermal waters than any country in the world. On the other hand, the non-volcanic mountain ranges of North America do not possess waters of this class. Among the British possessions there is in the North Island of New Zealand a remarkable group of hot springs at Rotorua, and in India there are a large number of valuable but undeveloped thermal sources. There are also famous hyperthermal baths in Japan.

A large, and from a medical point of view, an important, class of thermal waters have on account of their very low mineralisation been described as Simple or Indifferent Thermals. Gastein and

Plombières are typical of this group. Such waters are more generally employed for baths. They are, however, often taken internally, fasting and in sips, accompanied by gentle exercise. They act partly by their heat and high solvent power and hypotonicity, assist the solution and elimination of toxic material, and stimulate the biliary and intestinal secretions and the general circulation. They are, therefore, useful taken internally in cases of inactive liver, constipation and retention of toxins.

Sulphur Waters.—Sulphided or sulphuretted waters are found in almost every country, and there is no class of mineral springs that has enjoyed so high a reputation from remote times. 1. Many *thermal* waters are sulphided in varying proportions, usually in the form of sulphide of sodium. This salt is met with in traces at Aix-les-Bains, and increases to considerable quantities in the Pyrenean spas. Among the latter, Cauterets and St. Sauveur have 0·2, Barèges 0·4, and Luchon 0·7 per mille. These proportions are considerably exceeded in the hot springs of New Zealand. There are also many thermal salt-sulphur waters, such as those of Helouan (Egypt) and Hammam-Meskoutine (Algiers), which are almost exclusively employed for baths (*vide infra*). The water of Aix-la-Chapelle is, however, taken internally. 2. *Cold* sulphur waters usually contain a much larger charge of sulphur than the warm springs, especially in the volatile form of sulphuretted hydrogen. Challes, in Savoy, is a spring of exceptional strength, and contains the sodium sulphides to the extent of no less than 5 parts per mille. At the chief English and Welsh sulphur spas this element is combined with salt. The "Old Sulphur Well" at Harrogate contains 0·07 per mille sodium sulphide and 37 volumes of sulphuretted hydrogen, with 12·7 per mille of salt. Llandrindod is a milder salt-sulphur water with about 14 volumes of the volatile gas and 4 per mille of salt. Llanwrtyd, in Wales, Strathpeffer, in Scotland, and Lisdoonvarna, in Ireland, may all be described as pure sulphuretted springs, having respectively 36, 40 and 5 volumes of sulphuretted hydrogen per mille and no salt. Other famous cold sulphur spas are Schinznach, in Switzerland, and Eilsen, Nenndorf and Weilbach, in Germany.

A remarkably uniform tradition has given to sulphur waters a reputation in chronic scrofulous and skin disorders, in affections of the liver, and in certain kinds of dyspepsia. Many cases of chronic rheumatism, gout and gouty plethora undoubtedly benefit from their use. In the case of gout the exhibition of highly sulphuretted waters (Strathpeffer) causes a recurrence of tenderness and pain in the tissues that have been affected in previous attacks, which points to a selective and specific action of these waters. This is a form of "intensive" action, such as is often observed both as a result of waters and baths in chronic disease.* A course of sulphur waters and baths has long been regarded as assisting the specific action of mercury in syphilis (*see* Sulphur Baths, p. 133). Sulphuretted waters are generally slightly constipating, and are apt to cause a tendency to anæmia in predisposed subjects, which used to be regarded as a "blood moulting" process, due to a combination of sulphur with hæmoglobin. It is probable that some undetermined change does take place in the blood. When taken into the stomach the volatile hydrogen sulphide is rapidly diffused in the tissues and is finally eliminated by the skin as well as by the kidneys and bronchial mucous membrane.

Salt (Muriated) Waters. — These waters have as their principal constituent chloride of sodium, which enters into the composition of the blood serum and body fluids. The question of tonicity therefore arises, especially with regard to these waters. Among others, the following are nearly isotonic with the blood: Tarasp, Homburg, Uriage, Marienbad, Kissengen and Wiesbaden. Salt waters usually contain other chlorides and traces of iodine and bromine, and may be associated with carbonates and sulphates (alkaline and calcareous), with sulphides and with iron (*see* Alkaline, Sulphur, Purgative and Iron Waters). They may be thermal or cold, and may contain large quantities of carbonic acid gas.

The stronger salt waters (brines) are generally cold. They are derived from beds of sea-salt and from old marine deposits. Among the better known are Droitwich, in England (30 per cent. of salt), Rheinfelden and Bex, in Switzerland (about 26 per cent.), Ischl, in Austria (23 per cent.), and Salsomaggiore, in Italy (13 per cent.). In this group must be included Woodhall Spa, in Lincolnshire, which has a weak brine (2 per cent.). Such waters can only be used externally in the form of baths or sprays.

1. Among the *thermal* salt waters may be mentioned Wiesbaden (5 to 7 per mille), Aix-la-Chapelle, a salt-sulphur water (2·7) and Baden-Baden (2), all in Germany; in France, Bourbonne-les-Bains (5), and in Italy, Montecatini (4 to 18). 2. Common salt is the preponderating element in a large number of *cold* springs which are extensively used for drinking. Thus at Homburg salt waters (10) are associated with chalybeate springs. Kreutznach has the same proportion of chloride. In England Leamington has 8·5 per

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* See the Hunterian Society's Oration, "Some Principles in the Treatment of Chronic Disease," Lancet, April 23, 1910.

mille, and Cheltenham 5·6, both combined with small quantities of sulphate of soda. The effervescing salt waters are represented by Kissingen, cold (6), and Nauheim, sub-thermal, with about 12 per mille of salt.

Hypertonic salt waters (4 to 5 per cent.) may produce inflammatory changes in the intestinal mucosa. Moderate degrees of stimulation (*e.g.*, 1 to 2 per cent.) lead to the dilatation of the vessels, and as a result of hyperæmia, the power of absorption is increased. Salt waters tend to dissolve mucus, and liquefy the contents of the bowel. In the process of digestion they appear to facilitate the solution of the chyme. Absorption and general nutrition are stimulated by their use. Free carbonic acid gas powerfully assists their action on the gastric mucous membrane, especially when the waters are taken cold. Such waters are indicated in atonic states of the stomach and bowels, with or without catarrh; also in chronic catarrhs, pharyngeal, bronchial, vesical, etc.; in scrofula and in atonic gout. Hypertonic salt waters are useful in conditions of hydræmia and abdominal plethora, where the kidneys are sound.

Alkaline Waters.—These waters owe their alkalinity to the bicarbonate of sodium, which is often accompanied by free carbonic acid gas. In a large and important group of alkaline waters chloride of sodium is found associated in considerable quantities with the bicarbonate, which greatly modifies the action of the water. Sulphate of soda, salts of calcium and magnesium, silica, iron, arsenic, etc., are also met with in alkaline waters (*see* Sulphate, Iron, etc., Waters). Alkaline springs do not occur in Great Britain. The simple alkaline waters are represented by Vichy, in Central France (4 to 5 per mille of the bicarbonate), and Neuenahr, in Prussia (0·6). Both are thermal springs rich in carbonic acid gas. Vals, in Southern France, has cold alkaline springs, also gaseous, containing 1 to 7 per mille. All these waters are diuretic, render the urine alkaline and increase the elimination of uric acid. They reduce the appetite, diminish the glandular activity of the stomach, but appear to increase the secretion of bile. They are therefore given in acid dyspepsia, in biliary lithiasis, in abdominal plethora and in obesity; also in gout, and gouty glycosuria of stout and robust subjects.

The salt or muriated alkaline waters are many of them thermal and effervescing, like Royat, Châtel Guyon and La Bourboule, in the Auvergne Mountains, and Ems, in Prussia, and the waters of Pozzuoli, near Naples, and Gurgitello, in Ischia. The cold springs of the same class include Tarasp-Schuls (3,900 feet), in Switzerland, which is powerfully alkaline, St. Nectaire, in Auvergne, and

Castellammare di Stabia, on the Bay of Naples. The medicinal action of this group approximates to that of the milder salt springs. They are more tonic to the stomach than the simple alkaline sources, and therefore helpful in chronic atonic dyspepsia, with catarrhal conditions and constipation; also in tendency to uric acid gravel. These waters are often given to thin and weakly persons, for whom the stronger alkaline treatment is inadvisable. The presence of iron and arsenic, as at Royat and La Bourboule respectively, is also helpful in some of these conditions.

Calcareous or Diuretic Waters.—These springs exhibit salts of calcium—the carbonate (chalk) or sulphate (gypsum), or both, and sometimes carbonic acid gas. Bicarbonate of sodium is sometimes associated with the calcareous salts, as well as iron and small quantities of sulphates and chlorides. Among the *thermal* calcareous springs are Bath, in England, with 1·3 per mille of sulphate and 0·1 of carbonate of lime; Bagnères de Bigorre, in the Pyrenees (1,800 feet), with 1·8 sulphate and 1·0 carbonate, and Lucca, in Tuscany, with 1·7 sulphate of lime and 0·75 sulphate of soda; also Chianciano, near Siena.

A remarkable group of *cold* calcareous springs occurs in the Vosges Mountains. They contain the sulphate and carbonate of calcium in the following proportions: Contrexéville (1·5, 0·4), Martigny (1·7, 0·1), Vittel (0·4 to 1·4, 0·1 to 0·3). The cold gaseous waters of Wildungen, in Germany, and Pouges, in France, are to be distinguished by the absence of sulphate of calcium, and by the association of the sodium bicarbonate with the carbonates of calcium and magnesium. They are therefore alkaline calcareous waters. Lamalou, in the Cevennes, has a similar spring containing also bicarbonate of iron.

As a class these waters are powerfully diuretic, but do not render the urine alkaline. They are absorbed rapidly, and stimulate the appetite. They are therefore helpful in atonic dyspepsia, particularly in irritable functional conditions, gastralgia and a tendency to diarrhœa. They have a great reputation in urinary calculus and gravel, the free diuresis favouring the passage of concretions. They are also used with advantage in "arthritic" (gouty) states in weakly subjects, and oxaluria, and especially in the early stages of arterio-sclerosis. In these cases there is usually a deficiency of renal elimination with retention of toxins and spastic high tension (hypertonus of the arterioles). Calcareous waters favour renal elimination and often permanently reduce high arterial tension. On the whole, they are beneficial in proportion to their diuretic effect.

Sulphated (Purgative) Waters.—The stronger sulphated or "bitter" waters are not drunk at the source, but are bottled and widely employed as medicinal purgative doses. Some, like the Spanish waters of Villacabras, Carabana and Rubinat, contain large quantities (10 to 12 per cent.) of sulphate of sodium. There is another class of bitter waters, of which the Hunyadi-Janos and Friedreichshall furnish examples, in which the sulphates of sodium and magnesium are combined with the chloride and carbonate of sodium. The presence of chlorides and of the alkaline carbonate undoubtedly tends to make the action of the sulphate more gentle, and these waters are therefore more adapted for prolonged use in the majority of cases.

The sulphated springs that are drunk at the source are not of course so powerfully medicated as the bottled waters, but from their milder purgative and alterative action, they hold an important place in spa treatment. There are in England numerous weak sulphated springs, now disused, of which Epsom, Beulah Spa, near Norwood, and Purton, near Swindon, may be mentioned, but it may be questioned whether waters of this class (pure sulphate) are so beneficial, even in small doses, as those in which these salts are combined with others.

The potable sulphated waters are found in two main combinations: (1) Sulphates with alkaline carbonates; (2) Sulphates with chlorides. The first combination, the "alkaline sulphated water" is exemplified in the famous Bohemian spas. Karlsbad is a thermal water, whilst Marienbad and Franzensbad are cold. At these spas the proper effect of the sulphate is powerfully modified by the alkaline constituent. To this group might be added the thermal water of Tarasp (*see* Alkaline Waters). The second combination, the "muriated sulphated water," is represented in England by Leamington and Cheltenham. Leamington has a considerable chloride element, associated with sulphate of calcium. This should give the Leamington Spa some of the medicinal quality of the calcareous group of waters. Cheltenham is somewhat weaker in chlorides than Leamington, but stronger in sulphates. In France, Brides-les-Bains, and St. Gervais, a sub-alpine station, are mild muriated thermal waters of the same class, but weaker in salt.

The stronger sulphated waters are hypertonic. They, therefore, by osmosis set up a determination of fluid to the gastro-intestinal mucous membrane, increasing the fluid contents, both of the stomach and bowels. They diminish the secretion of the gastric glands. The alkaline and muriated sulphated waters are believed to stimulate the liver. These waters are therefore employed as purgatives and cholagogues in dyspepsia with plethora, in inactive liver, gall-stones and hæmorrhoids, especially in obese and congested subjects; also in some cases of chronic catarrh and in the more sthenic forms of gout and gouty glycosuria.

Sulphated Waters (Muriated and Alkaline).

	Sulphate of Sodium.	Sulphate of Magnesium.	Sulphate of Calcium.	Chloride of Sodium.	Bicarbonate of Sodium.
Brides-les-Bains : Thermal, 1,860 ft.	1·2	0·5	1·7	1·8	—
St. Gervais: Thermal, 2,075 ft.	1·7	—	0·9	1·7	—
Leamington : Cold, 200 ft.	1·2	0·9	2·0	8·5	—
Cheltenham : Cold, 150 ft.	2·2	0·3	—	5·6	—
Karlsbad Sprudel : Thermal, 1,230 ft.	2·4	—	—	1·0	1·3
Marienbad : Cold, 2,090 ft.	4·9	—	—	1·7	1·6
Franzensbad : Cold, 1,500 ft.	2·8	—	—	1·1	0·6
Tarasp-Schuls : Thermal, 3,890 ft.	2·1	—	—	3·6	4·8*

* Also carbonate of calcium, 2·4 per mille.

Chalybeate and Arsenical Waters.—In many countries a large number of mineral waters are medicated with the bicarbonate of iron, associated with carbonic acid gas. This gas, which keeps the iron in solution, is sometimes found in large quantities and gives to chalybeate waters their sparkling and effervescent quality. Spa, in Belgium (1,000 feet), which has given its name to mineral water health resorts in general, is a famous and typical example, with 0·9 per mille of the bicarbonate of iron. Schwalbach, in the Taunus (950 feet), is nearly similar. St. Moritz, an alpine spa in the Engadine (5,800 feet), has 0·04 of the same ingredient, with a little bicarbonate of sodium and magnesium. These are all rich in free carbonic acid gas, as also are Pyrmont, Rippoldsau, in the Black Forest, and many others. Tunbridge Wells possesses a valuable carbonated iron water (0·6 per mille), but without free gas. In Italy there are, amongst others, the alpine Santa Catarina, near Bormio (5,600 feet), and Recoara, near Vincenza. By a happy coincidence medicinal iron waters are often found in the neighbourhood of other mineral springs, as at Bagnères de Bigorre, Harrogate, Buxton and Strathpeffer—the association with sulphur waters being especially frequent.

Another kind of chalybeate water contains the protosulphate of iron. In England the most remarkable source of this kind is at Flitwick, in Bedfordshire (2·4 per mille), which, however, is only used after bottling. There is a considerable group of less known English waters of the same class, including Sandrock, near Blackgang Chine, Gilsland Spa, in Cumberland, St. Anne's Well at Brighton, Hartfell Spa, near Moffat, and Trefriw Well, in North Wales. Similar waters are those of Ronneby, in Sweden, Sandefjord, in Norway, Parad, in Hungary, and Auteuil, near Paris, and the strong thermal sulphated iron water of Pisciarelli, near Pozzuoli.

In addition to the foregoing, which may be regarded as *pure* chalybeates, there are various salt-chalybeate waters, like those of Cheltenham, and Haarlem, in Holland. There is also a large and important group of alkaline waters, including many thermal, in which carbonate of iron is an active ingredient. Such are the thermal gaseous springs of Royat, Châtel Guyon, Ems, St. Nectaire (salt alkaline chalybeate waters), the cold alkaline waters of Vals and Tarasp, and those of Neuenahr and Lamalou (thermal). At all these spas the medicinal effects of alkaline salts, together with those of chlorides in the case of the first-named stations, are combined with that of the iron salts. Cudowa and Reinerz, in Prussian Silesia, are also among the alkaline chalybeate spas.

Traces of arsenic (arseniate of soda) are met with in a considerable number of thermal springs, often associated with phosphorus, bromine, fluorine, silica, etc., and it occurs in more considerable quantities in many chalybeate waters. Arsenic is found with the protosulphate of iron in the well-known waters of Roncegno, in the Austrian Tyrol (1,700 feet), as also in many of the bicarbonated iron springs, such as the alpine and sub-alpine stations of Ceresole Reale, in Piedmont (5,290 feet), the Val Sinestra, near Schuls, in Switzerland, and Bussang, in the Vosges Mountains (2,200 feet). The group of muriated alkaline thermal waters in the Auvergne includes one strongly arseniated spring at La Bourboule, and several others, in which this element occurs in smaller quantities (Saint Nectaire, Royat and Mont Dore). There is also a cold alkaline arsenical spring at Vals.

Chalybeate waters, especially those that are aërated, are apt to produce, when taken internally, a sense of warmth and exhilaration. The pulse is quickened and there may be a transitory vertigo, fulness in the head or headache. These waters increase the motor and secretory activity of the stomach and are believed to stimulate general metabolism. There is evidence to show that a proportion of iron is absorbed by the mucous membrane of the bowel. Some passes away by the bowel, and the colour of the fæces is a useful indication of the amount of absorption that takes place.

The medicinal value of this interesting group of springs, at one time over-praised, is now perhaps too little appreciated. They have a wide application in conditions of convalescence and debility, in atonic dyspepsia, chlorosis and anæmia, particularly in young subjects and in advanced life. It is sometimes advisable to pave the way for a chalybeate treatment by a brief saline course or by small mercurial doses. The advantage of warming cold iron waters was long ago pointed out. The carbonated or gaseous waters are preferable in cases of gastric irritation. Atony and catarrh of the stomach and intestine, with feeble appetite, menorrhagia and leucorrhœa and consecutive anæmia and debility, anæmia from malarial cachexia and residence in the East, are among the conditions that derive benefit, not only from chalybeate waters—simple, alkaline, salt or arsenical—but also from the change of scene and diet, mountain air and perhaps stimulating baths, which are often associated with chalybeate waters. The arsenical waters, of which La Bourboule is the type, are with some reason regarded by the French physicians as indicated *par excellence* in the lymphatic and scrofulous maladies of childhood. They are used with good result in subjects of hereditary tubercle and syphilis, especially if affected with chronic catarrhs, purulent or otherwise, enlarged glands or overgrowth of lymphatic tissues. It is recommended that these waters be used in cases of adenoids before recourse is had to operation, and afterwards to promote the resolution of affected tissues. Among the skin affections of young subjects it is claimed that many cases of seborrhœa, lichen and eczema, due to constitutional causes, and some cases of psoriasis and ichthyosis, are cured by arsenical waters.

KINDS OF BATHS AND THEIR USES.

(1) **Thermal Baths.**—The effect of a thermal bath depends in the first place on its temperature and duration (*vide supra*). A third factor in the action, which is not so generally recognised, is the influence of the local climate. Thus at comparatively low elevations, and in warm sheltered valleys, baths may prove "enervating" or "exciting" to a sensitive or debilitated subject, who would on the contrary be refreshed and soothed by the same treatment at a sub-alpine spa. Atmospheric conditions profoundly modify the

effect of baths. At higher elevations higher temperatures can be borne without fatigue, than in the valleys, where the bath must be comparatively cool (sub-thermal) to produce a similar effect. The same statement applies to latitude. The temperature of the bath should, *cæteris paribus*, range higher in the north (high latitude) and lower in the south. The following table (after Braun) exhibits the temperatures of the springs and the elevation above sea-level of the chief European thermal baths.

Elevations and Temperatures of Thermal Baths.

	Elevation. Feet.	Temp. of the Spring. Degrees Fahr.
Panticosa	5,000	77—84
Loèche-les-Bains	4,670	102—124
Bormio	4,500	91—105
Gastein	3,315	78—121
Ragatz-Pfäffers	1,700	98
Baden-Weiler	1,425	81
Wildbad	1,323	91—104
Plombières	1,310	77—155
Buxton	1,000	82
Hammam-Meskoutine	900	115—203
Schlangenbad	900	81—89
Aix-les-Bains	850	109—112
Néris	800	102—126
Teplitz	648	83—114
Bath	100	104—120

Baths of this kind may be divided according to temperature into three groups, for each of which there is a well-defined therapeutic application.

(a) *Sub-thermal and Sedative.*—The temperature of the baths is somewhere near the point of thermal indifference (90° to 93° F.), ranging between 98° and 80° F., or a little lower. Moreover, the climatic character, the traditions and genius of the spa, promote and intensify the sedative action of the bath. Schlangenbad, Néris, Bains-les-Bains, Baden-Weiler, Ragatz, Plombières, and Buxton are stations of this kind. Sub-thermal baths are both sedative and stimulating, and have a very large place in spa treatment. The cardiac action is increased in force and markedly slowed; nervous excitation, whether peripheral or central, is diminished by the massive and equable impression of the water. These baths are therefore indicated in irritability of the vascular and nervous systems, as well as in general debility and motor weakness, and in peripheral and incipient and reflex paralyses, in hyperæsthesia, nervous insomnia and neuralgia. They favour nutrition, moderate senile changes, and are much used in degenerative arthritis, atonic gout and rheumatism, and nervous exhaustion and convalescence.

Prolonged Sub-thermal Baths.—Immersion in waters at the point of thermal indifference may be prolonged for many hours or even days without discomfort. At the sub-alpine spa Loëche-les-Bains (4,600 feet) baths at 93° to 95° F. are commonly prolonged for from one to six hours; and similar baths are taken at Néris (1,150 feet), Schinznach (1,140 feet), Bagnères de Bigorre (1,800 feet) and at La Bourboule (2,780 feet) and elsewhere. Their effect is both sedative and intensive. Besides their value for some intractable skin affections, they are useful in a variety of nervous disorders, visceral and especially entero-colic, neuralgias, sciatica, gouty arterial hypertension, and occasionally in exophthalmic goitre.

(b) *Thermal and Resolvent.*—The somewhat higher temperature of these baths, generally at or a little above blood-heat, introduces an active thermal influence (*see* Thermal Effect of Baths). In disease a mild intensive action is set up in the tissues and there is a liability to consecutive reaction. Bath, Gastein, Aix-les-Bains, Wildbad, in Wurtemberg, and Bormio are typical thermal spas.

These baths are stimulating in proportion to their heat, but unless of brief duration and terminated by cold applications are followed by a corresponding reaction and debility. They promote the absorption of chronic inflammatory exudations and congestions whether rheumatic, gouty or the result of traumatism. Thermal baths have a useful place in the treatment of cold and inactive skin, inveterate skin eruptions, torpor and inertia of the circulation or nerve centres, defective sensation or muscular movements, and many chronic painful disorders of muscles, nerves and joints.

(c) *Hyperthermal and Intensive.*—Such baths range in temperature from 104° to 130°. They are of necessity so limited in duration that the late and enervating effects of heat should not be developed. Japan and New Zealand furnish the most typical examples of natural hyperthermal baths, but at Teplitz, Hammam-Meskoutine and elsewhere various degrees of high temperature treatment are employed. It should be applied in practice with much care. The brief intensive and stimulant effect of these baths is helpful in many of the conditions enumerated in the last section, particularly in torpid skin and circulation. The hyperthermal foot-bath (*pediluvium*) is a valuable form of derivative treatment in many chronic ailments, and insufficiently employed at the British spas.

(2) **The Douche Bath** (Ital., *Doccia*).—All that has been said with reference to the action of heat in the bath applies to the douche, but in the douche the mechanical stimulation of impact is added, and there is no hydrostatic pressure upon the body. As in the case of immersion baths, there is in the douche a large range of stimulant and sedative effects.

(a) *The Hypothermal* (*Cool or Cold*) *Douche* is a powerful tonic and stimulant. Cold douches of brief duration are useful in many atonic conditions, neurasthenia and neuralgia, degenerative arthritis and functional paralysis, also in some cases of anæmia, in chronic glandular engorgements, and congestion and inaction of the abdominal viscera.

(b) *The Sub-thermal Douche* is applicable to many chronic joint affections. A good "head of water" is no doubt helpful in certain cases, powerfully adding to the mechanical stimulation, but the forcible douche should never be employed in a routine manner. On the other hand, large volumes of sub-thermal (thermally indifferent) water *at little or no pressure* have a grateful and sedative effect in vascular and nervous debility. This kind of douche can be safely and properly given, even in grave weakness, and in many cases of organic heart affection, to which immersion baths would be quite inapplicable. Massage can be usefully combined with this low pressure douche as well as with the more stimulating applications. The proper place and value of the *sedative douche* has been but little recognised. Indeed the douche bath as now given too often signifies a strong thermal and mechanical stimulant, which is wholly inappropriate for many invalids, for whom a sub-thermal douche, at little or no pressure, would be helpful. But without careful adjustment to the condition of each case, not only of the pressure but of temperature and manual stimulation, the sedative effect will not be obtained.

(c) *The Hot or Thermal Douche*, like the cold, is a powerful stimulant, and is applicable to similar conditions, but especially to many cases showing a defective power of reaction, to which the cold douche would be therefore inapplicable. It is also useful as an introduction to the cold douche. A douche bath alternating between hot and cold (*Douche Écossais*) often rouses the dormant power of reaction and stimulates nutritive processes. The hot, cold or alternating douche may also be applied locally in conditions of feeble and degenerate nutrition. The douche may be given in any posture and in any form—shower, needle, spray, jet, wave, spinal and the so-called "submarine" douche in connection with immersion baths. It is sometimes helpful to combine a tepid low-pressure douche to the trunk, with a more powerful hot douche to the limbs.

(3) **Hot Air Baths** (Turkish Bath; Fr., *Étuve sec.*).—Hot air chambers were much used by the Greeks and Romans.* The key to the action of Turkish and other hot air baths is their freedom from moisture. The surprising tolerance of the body for *dry* heat is explained by the fact that whilst immersion and vapour baths check evaporation, the hot air bath promotes it. Hence there is no considerable elevation of body temperature even in a prolonged Turkish bath. Perspiration is greatly increased, sometimes causing a loss of weight of as much as 2 or 3 lb. in one hour. The coincident inhalation of dry hot air greatly augments evaporation from the lungs. The pulse and blood pressure are at first raised, but lowered when perspiration is established. Hot air baths increase the circulation in the skin and by consequence bring about a *decongestion* of the deep-seated parts—liver, spleen, stomach, brain, etc. The function of the skin is assisted by cleansing and by the removal of epidermic accumulations and the contents of the glands. After the Turkish bath, frictions and cold affusions restore the tone of the superficial vessels and prevent the debilitating effect of heat. Hot air baths are of utility in a variety of chronic maladies, especially where elimination is defective, in the uric acid diathesis, chronic toxæmias, in some nervous affections and neuritis, in some cases of anæmia and chronic nephritis. They are contra-indicated in all febrile conditions, in cardiac debility and tachycardia, in Graves' disease and arterio-sclerosis. The *cabinet hot air bath* is applied to the body exclusive of the head. The action of heat is therefore mitigated as the hot air is not inhaled. The same applies to the electric light and radiant baths, in which the thermal agency is combined with luminous and other rays.

Local Hot Air Baths.—Hot air may be applied locally in a variety of ways, the part to be treated being enclosed in a chamber at the required temperature, 150°, 200°, 300° F., or more. The aqueous vapour and products of combustion (if any) should be carried away as formed. The action is an intense cutaneous congestion, sweating, and marked febrile elevation of temperature in the limb and to a less extent in the body at large. Pain is alleviated and secondary trophic effects may follow. It is highly necessary to use cold and tonic applications after hyperthermal treatment of this kind. Hot air may be used locally in many subacute and chronic joint affections, whether rheumatic, gouty, or degenerative (arthritis)—especially in their later stages, when the joints are swelled, and movement is limited and painful—also in local tuberculous affections, indolent ulcers, and in traumatism with imperfect resolution. Hot air has also been employed to relax and restore the circulation in spastic conditions, and to establish collateral circulation in obliterative endarteritis.

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* See Ency. Med., Article "Balneology," Section I., Historical.

(4) **Vapour Baths** (Ital., *Stufe;* Fr., *Étuve*).—Steam baths, natural or artificial, have been used in medicine from ancient times. The Russian bath is prepared by pouring water over hot stones, when a more or less saturated atmosphere at 120° or 125° F. is produced. Above that temperature aqueous vapour is intolerable. The cutaneous stimulation is increased by switching with birch twigs, or massage, and followed by applications of snow or cold water. The Romans utilised the vapour of the hot springs in their *thermæ;* and there are many natural vapour baths, like the cave at Monsummano (temperature 92° to 95° F.). In the island of Ischia there are hotter *stufe*, such as San Lorenzo (124 degrees) and Castiglione (133 degrees), and a similar one at the Bagni di Nerone, near Pozzuoli. The ancient Roman hyperthermal vapour bath is still in use at Plombières. Warm aqueous vapour softens the skin, induces perspiration and increases the fulness and frequency of the pulse. Both the cutaneous and pulmonary capillaries are dilated. Hot vapour baths soften and stimulate the harsh, hard, thickened and inactive skin. In sensitive subjects the regulation of temperature is essential. When a sedative and tranquillising influence is sought, the moisture must predominate over the heat (as at Monsummano). It may be stated as a general law that the heat of every thermal application should bear an inverse proportion to the febrile excitement or nervous sensibility of the patient. Assolini used vapour baths below blood-heat in inflammatory affections of the throat and respiratory passages. In chronic catarrhs a more stimulating vapour—Plombières, Mont Dore or Ems—can be employed. Natural, or artificial, vapours may also be applied locally, as at Aix-les-Bains and Luchon (the "Berthollet" bath), and at Bath and elsewhere. In addition to the indications already mentioned, vapour baths are helpful in painful rheumatic and gouty affections (lumbago, sciatica and neuralgia), and generally in the disorders for which the more stimulating and less sedative hot air bath is employed.

(5) **Salt (Muriated) and Marine Baths.**—Although there is but very slight actual absorption by the skin, the nervous end-organs are stimulated by particles of chloride of sodium, and to this the special effect of marine and other salt baths must be chiefly ascribed.

(*a*) *Strong Brine Baths.*—The Droitwich water is an almost saturated (30 per cent.) brine. Similar strong salt waters are those of Rheinfilden, 866 feet (26 per cent.), and Bex, 1,400 feet (25 per cent.), both in Switzerland; Ischl, 1,550 feet (23 per cent.), in Austria; Salies de Bearn, 100 feet (25 per cent.), in France; and Woodhall Spa (1·95 per cent.), in Lincolnshire. They are employed in the form of immersion baths and douches, as a powerful stimulant in painful chronic myositis and fibrositis (lumbago and sciatica), and generally in rheumatic and gouty affections; also as a tonic in convalescence. The "Limans," near Odessa, are salt lakes, originally connected with the sea, and concentrated by evaporation. The "Liman cure," which includes very hot natural sulphuretted organic slime and sand baths, locally applied, is highly esteemed for delicate children, for chronic rheumatic affections and traumatic contractions.

(*b*) *Muriated Baths.*—The less concentrated muriated waters, like those of Kreuznach, 340 feet (10 per cent.), and Salsomaggiore in the Apennines, 520 feet (13 per cent.), have a wide application. Both internally and in the form of baths and inhalations, these waters are used for many chronic catarrhal conditions, for enlarged glands, scrofula and rickets, for chronic nasal, pharyngeal, laryngeal and bronchial catarrhs, and for chronic inflammatory and catarrhal disorders of the female pelvic organs.

(*c*) *Marine Baths.*—The sea bath comprises several factors. There is first the proper effect of the salt water at the natural temperature, varying according to season and the coast. Secondly, the element of movement in the water. This again varies from the gentlest undulation to strong mechanical stimulation, equivalent to a rapid succession of douches. The constant movement of the water, the impact of the waves and the wind are all to be taken into account. It has been ascertained that the loss of heat in water moving at ½ metre per second is ⅓ more than in a bath of still water. On the other hand, the deposit of salt on the skin from a hypertonic bath inhibits the evaporation of sweat *after the bath*, and this, in addition to the salt stimulus of the peripheral nerves, makes the risk of "catching cold" much less after a marine than after a fresh water bath. Lastly, the local climatic influences modify the effect, in the sense of augmenting or diminishing the stimulus. The sea bath causes an energetic primary contraction of the skin vessels with the "first chill." The circulatory and thermic reactions are more rapid than with ordinary water. Hayem has well said that reaction is the "therapeutic event most desired and sought for." It is therefore important for the bather to leave the water before the "second chill," indicating the failure of reaction, occurs. Sea baths are believed to diminish the elimination of uric acid but to increase that of urea. All the vital actions are stimulated; body weight is increased. It follows that marine baths have their chief opportunity in lymphatic and scrofulous affections, local tuberculosis of glands, bones and joints, and in whatever conditions tonic salt baths are indicated. They are inadmissible in cardiac and rheumatic and gouty cases, in renal disease, bronchitis, emphysema, asthma, and in hæmorrhagic pulmonary tuberculosis and in other congestive states.

(6) **Effervescent Baths** (*Carbonated or Gaseous-Muriated or Alkaline-Baths, "Nauheim Baths";* Germ., *Luftperlbäder, Sool-bäder*).—Natural effervescing waters owe their acidulous quality to varying proportions of carbonic acid gas. This gas, dissolved under a certain pressure, is uniformly diffused through the water, and exists partly in the dissociated form as ions. When the pressure is reduced, as in the bath, the gas is liberated and attaches itself in minute bubbles to the skin. Among the *thermal* waters of this class are: Nauheim, in the Grand Duchy of Hesse, 400 feet (82° to 95° F.), which contains 2 to 3 per cent. of chloride of sodium; Oeynhausen, in Westphalia, 230 feet (77° to 91° F.), possessing a muriated water very rich in carbonic acid gas; Soden (Taunus), 450 feet; and Salins-Moutier, 1,610 feet at 96° F., with 1·3 per cent. of chloride of sodium. At Royat, 1,480 feet, the Saint Mart and César Springs furnish a valuable thermal effervescing bath, slightly alkaline and salt. Châtel-Guyon, 1,300 feet, has also an effervescent alkaline muriated water at 89° F., which is employed for "flowing baths." Among the *cold* waters there are effervescing chalybeate springs at Spa, in Belgium, 1,000 feet, at Schwalbach, 950 feet, and at St. Moritz, 5,800 feet, and "gaseous iron baths" are to be had at these more or less tonic stations at sub-thermal temperatures. Also at Kissingen, Bavaria, 640 feet, Tarasp-Schuls, in the Engadine, 3,890 feet, Marienbad, in Bohemia, 2,070 feet, and elsewhere.

The peculiar effect of effervescent baths is due to the contained carbonic acid gas, and is to be explained by the fact that the specific heat of this gas is $\frac{1}{5}$th that of water, whilst its conductivity for heat is only $\frac{1}{50}$th that of water. The point of thermal indifference for the human skin (*vide supra*) which is about 93° F. for water, is only 75° F. for carbonic acid gas, and in an effervescing bath the indifferent point must therefore lie somewhere between these two figures. As a rule, the cooler the water the more gas it will contain, and it is owing to the stimulation of the gas that such baths can be taken much cooler than ordinary baths. In an effervescing bath of say 90 degrees, the body is exposed to thermic stimuli both of cold and heat, co-existing side by side on innumerable contiguous parts of the surface, the cold stimulus taking effect where the skin is in contact with the water and the hot stimulus from the bubbles of gas. The total effect naturally depends on the temperature and duration of the bath. A brief bath is purely stimulant, whilst a prolonged bath is sedative and tonic. On entering an effervescing bath below skin temperature there is a momentary chilliness, soon succeeded by a sense of prickling, or warmth, due to the collection of innumerable bubbles on the skin. The vaso-constrictor action of cold is presently antagonised by the vaso-dilator action of the gas, the arterioles relax, and there is a more or less intense reddening of the surface. Diaphoresis and diuresis are reflexly encouraged. Following the direct effect upon the skin, there is an indirect result upon the distribution of the blood, known as "decongestion of the viscera" in obedience to the law of inverse relation between the circulation of deep and superficial parts (*vide supra*). The heart's action becomes less frequent, to the extent of perhaps of four to six or ten beats less per minute, the systole stronger, and the pulse more ample, from dilatation of the artery. The effect on the blood pressure varies. It is reduced in baths above the skin temperature, where the vaso-dilator action of the gas has overcome the vaso-constriction of cold, and in all cases where the peripheral vascular dilatation is marked. Many observers have noticed, by percussion or by the X-rays, a diminution in the cardiac area, especially on the right side, after effervescing baths. The effect on the nervous system is that of a mild, continuous sub-thermal stimulation, passing into sedation. These baths combine the tonic and antipyretic effect of cool temperatures with an active peripheral stimulation. The presence of sodium chloride with the gas accelerates and enhances the peripheral effect.

Effervescing baths are often, in the writer's opinion, given too hot. In the majority of cases it is well to begin at about skin heat (93 degrees) and, if the bath is well borne, work slowly downwards. It is customary to increase the saline strength and also the duration of the bath as the course progresses. The character and frequency of the pulse, *during* and *after* the bath, afford much guidance in the conduct of the case. Absolute repose must be enjoined before the bath and after leaving it. The effervescing bath, properly graduated as to temperature and duration, is a powerful tonic for the feeble heart. The conditions that may be expected to benefit from its use are: Atonic dilatation as a result of illness such as influenza or anæmia; heart weakness from ailure of compensation in old valvular disease, especially of the mitral valve; early degenerative changes in the myocardium; functional disturbance from increased peripheral resistance, toxæmic or otherwise. Habitual arterial hypertension is always associated with undue contraction of the superficial vessels. In this condition effervescing baths may be expected to moderate and equalise vasomotor action, and restore the balance of the circulation. The writer agrees with J. Hertz that, even where the high tension is accompanied by albuminuria, sub-thermal baths are often beneficial. They are also useful for their sedative effect in the vasomotor disturbances of the menopause. Effervescing baths are employed as a tonic in the debility following acute illness and hæmorrhage, in anæmia, in many cases of neurasthenia, hyperæsthesia, and peripheral paralysis. They are believed to encourage menstruation, and are therefore sometimes given where this function is painful or in abeyance. They are contra-indicated in acute or recent endo- or myo-carditis, in advanced aortic disease and aneurysm, in cardiac dyspnœa, and emphysema, also in persons showing a tendency to hæmorrhage.

What has been already said with reference to the modifying influence of climate and surroundings in spa treatment applies emphatically to the use of effervescing baths in serious cases. Many invalids for whom this form of balneotherapy might be properly employed are not well enough to travel far from home. For use at or near home, artificial effervescing salt baths are employed in this country, affording the physician considerable choice of locality. In the summer time the northern sedative air of Strathpeffer is a helpful factor in some cases, or the bracing situation of Harrogate. In winter the warm and more sheltered climate of Matlock Bath may be a desirable factor, or that of the west country (Bath, Sidmouth, or Bournemouth).

(7) **Sulphur Baths.**—A very large number of thermal waters are impregnated with sulphide of soda, and to a less extent with sulphuretted hydrogen. These "thermal sulphur spas," which are mainly used for baths, are situated often in beautiful mountainous scenery, and owe their thermality to bygone volcanic action. It is, however, doubtful whether the sulphide which they contain exercises any appreciable effect in the bath, since it is not absorbed by the skin. There are, of course, in this large group of baths, many interesting and valuable individual characters, not only in the waters but in the climate and local circumstances. They include, in France, the famous Pyrenean spas: Luchon (2,050 feet), Cauterets (3,200 feet), Barèges (4,200 feet), Saint Sauveur (2,500 feet),

Eaux Chaudes (2,050 feet), Vernet-les-Bains (2,060 feet), Amelie-les-Bains (920 feet); Ax-les-Thermes (2,340 feet) and Uriage (1,350 feet); in Germany, Aix-la-Chapelle; in Switzerland, Baden (1,200 feet), Lavey (1,350), Schinznach (1,140 feet) and Yverdon (1,430 feet). In Northern Italy there are the hyperthermal water of Vinadio, in Piedmont (4,360 feet), possessing also a series of sulphur vapour baths or *stufe*, Acqui and Poretta; Viterbo, near Rome, and Acireale and Sciacca, in Sicily. In Austro-Hungary there are Pöstyen, Trencsin-Teplitz and Hercules Bad (*Thermæ Herculis* of the Romans) in the Carpathian Mountains, besides the sub-thermal Baden, near Vienna. Egypt has a thermal sulphur water at Helouan. There are many springs of this class in California and Colorado, some employed for baths; in Canada there is the "hot sulphur spring" near Banff; New Zealand has one at Rotorua, and there are many in Japan and India.

Some cold sulphur waters are extensively employed for baths in Great Britain. The muriated sulphur springs of Harrogate and Llandrindod, and the pure sulphur waters of Strathpeffer and Llanwrtyd are so used; also, in Switzerland, Lenk (3,600 feet), and in Norway, Sandefjord and Laurvik. Sulphuretted hydrogen is a volatile gas, and is undoubtedly capable of absorption by the skin. In small quantities it stimulates, in larger quantity it irritates the surface of the body. It is regarded as a mild antiseptic and anti-parasitic, and sulphur baths have an old reputation for scabies. Strong sulphuretted waters like those of Strathpeffer, when artificially heated to a sub-thermal temperature, have been found in the experience of the present writer of considerable service in moist irritable eczema at the climacteric epoch, as well as in localised forms of dry gouty eczema, in pruritus and in acne. Such baths, also, in his own experience, often alleviate the pains of chronic gouty and rheumatic affections. Thermal sulphur baths, together with sulphur water internally, have long been employed as an auxiliary in the mercurial treatment of syphilis. They may, at all events, be regarded as "a powerful aid to the specific methods" (Weber). This treatment has been developed more particularly at Aix-la-Chapelle, at Uriage, at Bagnères de Bigorre and at Wiesbaden. Inunctions of mercurial ointment are given by skilled rubbers after the thermal bath. No doubt waters of this kind, especially those containing alkalies, greatly improve the condition and function of the skin, and by assisting the removal of fatty matters and epithelial *débris*, favour absorption of the ointment. But the sulphur treatment also operates in syphilis by promoting the elimination of toxins. Under the use of these waters and baths larger doses of mercury can be administered by the skin than would otherwise be tolerated. Sometimes during the treatment local syphilitic symptoms may be temporarily increased, which is not regarded as an unfavourable sign. It is in truth an example of "intensive" action, the chronic lesion becoming more acute in its progress towards cure. The treatment of syphilis in the warm, moist atmosphere of the baths is indeed tantamount *inter alia* to a change to a warmer climate. It is believed by many that warm climates may in certain cases be favourable to the cure of syphilis, promoting a more acute and rapid action, whilst in cold climates the same malady often tends to chronicity.

(8) **Peat Baths** (Germ., *Moor und Schlamm Bäden*).—Peat or moor baths are prepared from the brown organic deposit underlying, often to a considerable depth, the more fibrous "fuel peat" in many northern peat mosses or bogs. This material consists largely of humus derived from the decomposition of sphagnum moss, and contains resins, silica, free sulphuric acid, and generally carbonate of iron and various salts. When exposed to the action of heat, formic and other volatile acids are produced. Peats are usually classed as ferruginous, saline or sulphuretted; and at many spas are fortified by mixture with the mineral water or with "mother lye."

During the last century the use of these baths has been especially developed in Bohemia. At Marienbad and Franzensbad the peat is strongly ferruginous, and a single bath is said to contain nearly 1 lb. of formic acid and other volatile substances. As the specific heat of peat is much lower than that of water, peat baths can be given at relatively high temperatures. The point of thermal indifference for the peat bath is placed by Kisch as high as 102° F. In suitable cases they may be given at temperatures ranging from 110° F. to 112° F., and the higher temperatures are well borne if the bath is followed by cold affusion, as at Strathpeffer. The layer of peat nearest to the skin rapidly cools to about the skin temperature, and the presence of this comparatively cool and non-conducting layer moderates and equalises the effect of heat. To the thermal influence are added the effects of compression and of the friction of the semi-solid poultice-like mass, as well as the active chemical stimulant effects of the volatile constituents on the surface of the body.

In Great Britain peat baths were first employed at Strathpeffer, and are now used at Harrogate and Buxton; also in Germany, at Pyrmont and Schwalbach, etc., and at Ronneby, in Sweden. They furnish a convenient form of thermal treatment with marked cutaneous stimulation. They are prescribed for torpidity of the skin and circulation, in neuralgia and neuritis, especially of the peripheral nerves, in disorders of common sensation, in chronic rheumatic affections, and to promote the absorption of morbid deposits, as in pelvic peritonitis. They are also employed locally at high temperatures to the feet and legs, the arms or abdomen, either for their derivative effect, or to set up active hyperæmia in chronic arthritis, etc.

(9) **Mud Baths** (Fr., *Bains de Boue*, It., *Fango*, *Sulphur- or Salt-Mud Baths*).—At many thermal sulphur spas soft "butter-like" deposits are obtained from the vicinity of the springs, which are used as an application, often at high temperatures. At Pöstyen and Mehadia, in Hungary, and at the northern Italian spas (Vinadio, Acqui, Battaglia, Abano), as well as at Baden, near Vienna, a sulphuretted mud, or *fango*, is extensively employed. It is also imported into England for local applications, as at Matlock. The whole bath may be given at 104° F., and at much higher temperatures (120° F. or 122° F.) applied locally. These deposits, besides containing various mineral and organic matter, often exhibit a high degree of radio-activity. A similar mud is obtained from river deposits at Dax, near Bordeaux. In Germany sulphur mud baths are used at Eilsen and Nenndorf, and in Sweden at Loka, in combination with massage.

A second variety of mud baths is prepared from sea, or salt mud, such as those of the "Limans," on the Black Sea coast (*see* Salt Baths), and of Saki and others in the Crimea. The salt mud is heated by the sun, or artificially, to a high temperature, and plastered over the body, either wholly or partially. Similar salt muds are used at Laurvik, Modum and Sandefjord, in Norway, at Ischl and at Arensburg, in Livonia. Mud baths are essentially a hyperthermal treatment. The indications are the same as for peat baths, but the strong salt muds, like those of the "Limans," are especially valued for chronic rheumatism, for scrofulous conditions, and as an accessory treatment for syphilis. The pressure exerted by the mud has been regarded as helpful for the relief of varicose veins.

(10) **Sand Baths** (*Arenation*).—This ancient method of thermal treatment consists in immersing the body, wholly or in part, in sand, heated—by the sun or otherwise—to from 110° to 130° F. Profuse perspiration ensues; the skin becomes reddened and encrusted with sand; and, the normal loss of heat being reduced, the body temperature may rise three or more degrees. These bath have been used since Roman times in the island of Ischia,

and recently at Lavey, in Switzerland, and Koestritz, in Germany. They are employed sometimes, together with sun baths, for their special thermal effects in chronic diseases of the joints, especially degenerative arthritis. Cold, moist sand baths are also used as a vascular and nervous tonic in neurasthenia.

(11) **Acid Baths.**—Certain thermal waters, particularly the geyser springs of New Zealand and America, are distinguished by the presence of free acids. Free hydrochloric acid is present in considerable quantities in the Lemonade Spring, in California, at Tuscarora Sour Spring, in Canada, and in certain hot waters in Japan. One of the most remarkable of acid springs is to be found among the Oak Orchard Springs, in New York State, which is said to contain free sulphuric acid in the proportion of 40 per cent. of its total mineral content. The same acid exists, with or without hydrochloric acid, in the "acid sulphur waters" of Rotorua (New Zealand), to the amount of from 4 to 22 gr. per gallon. These waters and the geyser springs of the Yellowstone National Park (America), and of Iceland, contain large quantities of silicic acid. There is in Europe nothing comparable to this class of waters. They are not employed internally. In the bath their action is stated to be powerfully rubefacient and decongestive.

INDICATIONS AND CONTRA-INDICATIONS.

The indications for waters and baths cannot be sharply defined. They depend to a great extent, like the choice of a spa, upon the individual rather than upon the name of his disease. The patient's age and general condition, and especially his degree of reaction to waters and to thermal stimuli, a most variable factor, must be taken into account.

(1) **Cardio-Vascular Affections.**—(*a*) There are various types of *vasomotor disorder* which are amenable to spa treatment. They are marked by unequal distribution of the blood, areas of congestion and atony co-existing with cold areas of arterial spasm. (i.) Neurasthenic vasomotor conditions: These are marked by excessive sensitiveness of certain vasomotor areas. They are common in middle life and at the menopause, especially in gouty subjects. The bath treatment is essentially sub-thermal and sedative. Quiet, sedative spas, upon wooded hills, in tranquil surroundings, such as Schlangenbad, Néris, Royat, Gastein and Buxton, or Bath in winter, are indicated, but high elevations and high temperatures are to be scrupulously avoided. (ii.) Sluggish vascular reactions, with chilly skin, usually associated with "internal catarrh" and indigestion: Many young persons, especially those of

gouty inheritance, exhibit this condition, with deficient oxidation and want of bodily heat. Stimulating thermal applications (both cold and hot) are here indicated, especially peat baths (Marienbad and Strathpeffer), and hot and cold douche baths and brief hyperthermal baths. (iii.) High arterial pressure, either from *hypertonus* or early arterio-sclerosis. Sub-thermal baths and douches with massage, Aix-les-Bains, Bath, Buxton, Vittel, and the sedative spas enumerated above; also effervescent baths.

(*b*) *Sub-acute Conditions of the Superficial Veins.*—Periphlebitis and phlebectasis, usually of a gouty origin. Any active thermal treatment, especially if combined with massage, is apt to precipitate focal phlebitis. In all sensitive and sub-inflammatory states of the veins, only the most sedative baths and applications are admissible, but eliminative treatment is usually indicated. Much resort is made for varicose veins to Bagnoles d'Orne, and mud baths are also considered useful for their pressure effects.

(*c*) *Cardiac Affections.*—It cannot be too clearly stated that no treatment by waters or baths of any kind should be employed in the presence of active or recent morbid changes in any part of the heart. It is contra-indicated, for example, in the case of recent rheumatic carditis, whether the part affected be the pericardium, the muscular wall or the valves. Such a condition demands, above all else, rest. On the other hand, when there is reason to believe that the active process has entirely subsided, the presence of valvular defects is no bar to the use of baths. But it should be remembered that persons suffering from any weakness of the heart are peculiarly liable to suffer from the debility that follows thermal applications, which has been already described as the "reaction to heat." Hence it is that in all forms of heart affection the temperature of the bath should seldom equal that of the blood, and never exceed it. In all such cases only sub-thermal bath temperatures are admissible, that is to say, having the skin temperature (93°) as a middle point, and for extremes 80° and 98° F. There is for these invalids a considerable choice of balneary procedures. The *sub-thermal* douche, at *low pressure*, without the excitement of impact, may be used, with or without skilled and gentle massage. This forms a useful sedative and tonic in inequalities of the circulation and for the weak and irritable heart (*see* Douche Baths). Immersion baths at suitable temperatures are equally applicable (*see* Sub-thermal Baths). The salt, and especially the effervescing bath, sets up a more active and continuous peripheral stimulation, and should therefore be given at lower temperatures than ordinary baths. The practitioner will in every case observe for himself the effect that is produced. The change in the character of the pulse and of the cardiac systole is often remarkable. A small and frequent pulse becomes after a few minutes immersion large and full, whilst the heart's action becomes stronger and slower. An account of these baths and of their employment in heart affections has been given in a previous section (*see* Effervescent Baths, p. 131). Grave injury may be done by over-heating or fatiguing the patient in these cases. No hot bathing sheets, close dressing-rooms or the slightest agitation, hurry, or subsequent exertion are permissible. The influence of season and of climate, and the question of travelling, as affecting the use of these baths, have been already alluded to.

Many cases, in which the heart weakness is not serious or advanced, benefit from various forms of *exercise*. The "resisted movements" employed at Nauheim, Homburg and elsewhere, are adapted from the well-known system of Swedish gymnastics, in which the muscular exercise is carefully graded by the hand of a skilled attendant. A more active form of exercise, without the same nicety of gradation, is provided by the appliances of mechano-therapy. At many continental spas various apparatus, like those of Zander, with weight resistance, are employed. Mechanical treatment of this kind may easily be overdone. Lastly, the graduated walking and climbing exercises, the so-called "terrain" cure, have a wide application in slight cases, especially at bright and bracing health resorts, of low or medium elevation, in fine air and on wooded hill-sides. It must be added that in many cases all forms of exercise are inadmissible for which baths may be helpfully employed.

(2) **Dyspepsia, Constipation, Disorders of the Liver and Colon.**—(*a*) *Dyspepsia* due to excessive or over-stimulating food and insufficient exercise may be corrected by a course of eliminative waters and baths, always combined with appropriate diet and regular exercise. The more or less purgative waters of Harrogate, Karlsbad, Marienbad, Homburg and Brides-les-Bains, and the alkaline waters of Vichy and Vals, are often helpful. The latter spas are particularly indicated in hyperchlorhydria and in gouty and hepatic dyspepsia.

(*b*) In *atonic, catarrhal and nervous dyspepsias*, on the other hand, milder waters are indicated. For neurasthenic individuals simple thermal spas may be recommended, at a moderate or sub-alpine elevation, or among quiet wooded valleys, such as Schlangenbad, Plombières, and Buxton. Sometimes weak muriated waters (Llandrindod, and Baden-Baden), or sulphuretted waters (Strathpeffer), with the fine air of these spas, are of service in gastric catarrhs; or an effervescing alkaline-muriated thermal water, such as that of Ems, which is a warm place, or that of Châtel Guyon or Saint Nectaire, more bracing stations, in the Auvergne Mountains. In dyspepsia with anæmia an effervescing chalybeate may be prescribed, especially if at a high elevation (Spa, Schwalbach, Royat, St. Moritz). Tonic baths and regimen may properly be associated with waters in the depressed conditions of health that accompany all these forms of dyspepsia.

(*c*) In obese and congested persons, with *disorders of the liver*, with or without gall-stones, a course of alkaline waters is often beneficial, as at Vichy and Vals. The sulphated alkaline waters of Karlsbad enjoy a good reputation in cholelithiasis. Karlsbad, Kissingen, and Harrogate are much resorted to for catarrhal jaundice and "inactive liver" and hæmorrhoids. Chronic hepatic derangements, such as follow residence in the East, are much in evidence at the Bohemian spas (Karlsbad, etc.) and at mild muriated springs like Cheltenham and Leamington. The passage of gall-stones, as of urinary calculi, is not uncommon during a course of spa treatment.

(*d*) The treatment of *constipation* must be directed to its cause, whether waters, baths or other remedies be in question. The indications for the atonic form of constipation are the same as for atonic dyspepsia, supplemented often by douche baths, massage and exercises. There is, on the other hand, an equally common form of constipation in which there is chronic fulness of the splanchnic area and a spastic and irritable condition of the colon. This is often aggravated by ordinary tonic measures. It may, however, sometimes be relieved in a remarkable way by a more sedative form of bath. The sub-thermal baths of Plombières or the flowing "decongestive" baths of Châtel Guyon allay irritation, and at the same time open up the peripheral circulation. The irrigation of the colon by means of mineral water, sometimes described as the "Plombières treatment," and widely used in what has been termed "muco-membranous colitis," may sometimes be helpful in a minority of cases. The catarrhal irritation of the colon, with recurrent painful "colic," which is so often the result of chronic constipation in neurasthenic subjects, is usually a spastic condition, and is often relieved by such baths as those above mentioned. The muriated waters of Homburg and Kissingen may be employed in the same manner.

(3) **Gout, Glycosuria, Obesity, Albuminuria, Urinary Lithiasis and Cystitis.**—In many cases of *gout* baths of all sorts are contra-indicated, and treatment must be confined to the internal

use of waters with dieting. In others, a suitable course of baths alone will secure a long immunity from symptoms. This is equally true whether the gouty manifestation be orthodox and articular, or, as is so often the case, located in the digestive, circulatory, cutaneous, bronchial or nervous tissues. The eliminative function and the normal tissue exchange may be alike restored.

Gouty ailments of the congestive variety in stout and more or less vigorous individuals, can be appropriately treated on eliminative lines by alkaline and purgative water (Vichy, Karlsbad, Marienbad, and Harrogate). It is probable that at many sulphur spas (Strathpeffer, Harrogate, Llandrindod, Cauterets, Schinznach, and Uriage), the action of the waters in gout may be more direct and almost of a specific nature. Gouty disorders are particularly amenable to treatment by cold or thermal sulphur waters. The milder alkaline and muriated spas, like Royat, Kissingen, and Wiesbaden, are particularly appropriate in atonic gout. Again, there are many chronic gouty conditions in which a course of thermal baths, with or without massage, as at Aix-les-Bains or Bath, is more helpful than any other form of treatment. There is in fact no disorder in which it is more necessary to consider individual characteristics.

Many cases of *glycosuria* of a gouty type in stout or robust subjects are benefited by mineral waters, especially by the alkaline and muriated spas (Vichy, Neuenahr, Contrexéville and Llandrindod). For more delicate subjects the thermal waters and baths of Royat, Buxton, and La Bourboule are by preference indicated.

Obesity in subjects of a florid and plethoric habit with habitual over-feeding and hyperactive digestion, is often amenable to a course of eliminative waters, combined with rigid dieting and exercise. Such is the treatment at Marienbad, Karlsbad, Kissingen and Brides-les-Bains. Alkaline waters, like those of Vichy, are also helpful in some cases. Where the heart is sound, a course of natural vapour baths, as at Plombières, promotes the eliminative action. Another type of obesity is seen in anæmic subjects, often with weak cardiac action. The salt waters of Brides are not contra-indicated for these cases, and they may be combined with a course of tonic effervescent baths. Cool and cold baths and douches may be employed in obesity, for their powerful effect in promoting circulation and tissue change. High and bracing resorts are also chosen for the same reason. At many stations systematic walking and climbing exercises are prescribed for obese persons, as at Marienbad, Baden-Baden, Reichenhall, in the Bavarian Alps, Brides and Pralognan. Systematic exercise, especially at elevated and bracing places, is a valuable aid to the treatment.

The development of *nephritis* can sometimes be postponed for many years by appropriate hydrological treatment of the gouty condition. The existence of albuminuria does not contra-indicate the moderate use of waters if the total quantity of urine passed is not already excessive. If casts are present, waters should not be used.

For *renal calculi*, whether of uric acid or oxalate of lime, the diuretic waters of the Vosges (Contrexéxille, Martigny, Vittel, and Wildungen, in Germany), are much resorted to (*see* Calcareous Waters), and such calculi are frequently passed during the treatment. For persons of a plethoric or constipated habit the purgative sulphated waters of Karlsbad and Marienbad are preferable. The diuretic waters of the Vosges and of Évian are beneficial in the case of *insufficient renal action* with consecutive toxæmia and high arterial pressure; also in some cases of *pyelitis* and *cystitis*. Cystitis of a gouty and congestive type should, however, be referred to alkaline waters, such as Vichy and Vals.

(4) **Rheumatism, Sciatica, Lumbago.**—In the affections of the joints and fibrous tissues that gradually supervene upon exposure to cold and damp and traumatism, many forms of baths are beneficial. In subacute or recent cases thermal treatment must be gentle and tentative, in chronic cases more stimulating. For stiffness or adhesions, the result of bygone inflammation, a highly stimulating thermal treatment may be employed, and local applications made of brines, peats, muds, vapour and hot air in an ascending scale of temperature. The employment of these agencies in rheumatism is referred to more particularly under Thermal, Peat, Mud and Vapour Baths (*see above*). Some brine baths (Droitwich), as well as certain natural vapour baths (Monsummano), have obtained a reputation in sciatica and lumbago, but it is obvious that these symptomatic disorders, like dyspepsia, should be treated from the point of view of causation.

(5) **Arthritis.**—In chronic degenerative arthritis, whether of gradual onset or the result of an acute invasion (such as rheumatic fever, gonorrhœa, primary acute or septic arthritis or acute gout), the object of treatment must be to favour elimination of toxic material, promote the failing nutrition of the part, and finally to correct deformities and restore function. All forms of chronic arthritis are at one stage or another amenable to spa treatment. It should, however, be carefully adapted to the case in hand, and to the stage and phase of the complaint. In the early or sub-acute stage, which may be extended for years, only a sedative or subthermal bath is appropriate, such as the *low pressure* douche with

massage. At a later stage, when inflammatory reaction has subsided and degenerative changes are marked, the arterial circulation in the joint is apt to fail, and local thermal or hyperthermal applications are beneficial by stimulating the nutritional and circulatory activity. Such cases do well at thermal spas (Aix-les-Bains, Bath, Luchon) where the administration of the douche has been made an especial study and tradition, and the bath is given only by skilled and experienced attendants.

The baths and douches employed in cases of arthritis are in the writer's opinion often given too hot. In no class of cases is it more important to avoid the debilitating reaction of heat. In his own experience he has often found brief *cold* douches, or the *douche Ecossais*, of value in the arthritis of young and middle aged persons. In the arthritis of middle life, and in senile localised arthritis, the result of slight injuries in later life, appropriate baths may have the happiest results. In senile arthritis a summer "cure," with sub-thermal baths in pure but sedative air, may relieve pain, assist nutrition and defer atrophic changes.

(6) **Anæmia and Chlorosis.**—The anæmia commonly associated with digestive disorders in young subjects is often amenable to spa treatment. If there is also constipation and portal congestion, a short course of sulphated or salt waters like those of Franzensbad, or Brides-les-Bains, or of sulphuretted, or salt-sulphuretted waters, like Strathpeffer, Harrogate or Llandrindod, may be advantageously prescribed. In delicate subjects showing a tendency to gastric or other catarrhs the salt chalybeate waters are more appropriate, such as Cheltenham, Homburg or Royat. For these and for many other slight symptomatic anæmias, effervescing carbonated chalybeate waters, such as those of Spa, Schwalbach and St. Moritz, have been long employed, both internally and as baths; also certain ferruginous and arsenical waters at high elevations, like La Bourboule and Roncegno. As a rule, only slight cases with fair power of reaction should be sent to elevated stations. The treatment of possible toxæmic causes, such as tuberculosis, malaria and chronic pus formation should not be overlooked. Lastly, tonic measures and regimen, including cold douches, friction and brief hyperthermal baths, are often as helpful as waters in anæmia and chlorosis (*see* Chalybeate and Arsenical Waters).

(7) **Chronic Specific Invasions: Catarrh, Tuberculosis, Syphilis, Malaria.**—For young subjects in the pre-tuberculous and "tuberculisable" stage, the object of treatment is to restore the normal resistance of the tissues to the invasion of the bacillus. In

particular the respiratory mucous membranes may be fortified and recurrent catarrhs prevented. In addition to hygienic and dietetic methods, and the powerful influence of marine climates, an occasional course of mild muriated chalybeate or arsenical water may be helpful to this end (*see* Salt and Chalybeate Waters). The same treatment can be employed where the bones, joints or lymphatic glands are already affected with tuberculous disease, provided that the latter is definitely local and non-febrile in character. Certain spas have enjoyed a considerable reputation in dealing with "scrofulous" affections. Brine baths and other external applications are employed at Bex, Salsomaggiore, Kreutznach, Salies-les-Bearn, and at the Limans, on the Black Sea coast, as well as salt sprays and pulverisations for the respiratory passages. The catarrhal conditions so commonly met with in chronic afebrile pulmonary tuberculosis may sometimes be relieved by the "sedative" inhalations and fine sub-alpine climate of Mont Dore (3,440 feet). In young subjects catarrhs of the naso-pharynx may be treated by arsenical muriated waters and sprays at La Bourboule. Older subjects, in whom the mucous membrane of the larynx is similarly affected (*e.g.*, "clergyman's sore throat"), often resort to Cauterets or Luchon, in the Pyrenees, or to such muriated waters as Ems. At Mont Dore the treatment is assisted by "derivative" footbaths at hyperthermal temperatures. For bronchial catarrhs in gouty subjects the only appropriate treatment is that of the underlying condition (*see* Gout).

The mercurial treatment of *syphilis* may in many cases be suitably combined with a course of sulphur waters and baths (*see* Sulphur Waters), especially where it is desired to obtain a rapid and intensive action. Where there is considerable constitutional disturbance and anæmia a bracing spa, such as Luchon or Uriage, may be preferred. The baths at Aix-la-Chapelle and Wiesbaden can be taken at any period of the year.

Cases of *malarial cachexia* and anæmia, from long residence in tropical countries, are often benefited by waters and baths, varied according to individual indications. In delicate and anæmic subjects a course of sub-thermal baths at a considerable elevation, such as Plombières or Wildbad, may be preferred. For cases with hepatic and splenic enlargements the Bohemian spas, and especially Karlsbad, have a high reputation. In malarial anæmia bracing climates and chalybeate or arsenical waters may be helpful (Schwalbach, La Bourboule).

(8) **Skin Affections.**—Among common functional disorders, the chronically inactive, torpid and often chilly skin, with poor

peripheral circulation, requires an active thermal treatment. Brief hyperthermal, sulphur or peat baths, from 105° F. upwards, and the alternating douche, are very helpful. Hot air and especially vapour baths remove epidermic and glandular accumulations. For the ill-nourished and senile, dry or atrophic skin, as well as for pruritus, soft, peaty, alkaline, sulphur and silicated baths may be employed, as at Strathpeffer, Cauterets, Bagnères de Bigorre, Plombières, Bains-les-Bains. Sulphuretted waters are peculiarly appropriate to many skin affections. In many forms of irritable gouty eczema, as at the climacteric, alkaline or sulphur baths at an indifferent heat may be used (Strathpeffer, Royat, Schinznach). For localised and dry eczemas higher temperatures are employed. Psoriasis and ichthyosis and dry chronic eczema may be relieved by hot sulphur baths, or by prolonged sub-thermal baths, as at Leukerbad. Acne and furunculosis are also amenable to sulphur waters, but often exhibit temporary exacerbations under their use (*see* Sulphur Baths).

(9) **Uterine and Ovarian Disorders.**—Conditions of vaginismus and dysmenorrhœa in early married life, the symptoms of a general irritation and neurasthenia, are sometimes notably benefited by recourse to sedative baths and climates, such as Néris, Schlangenbad, Buxton (*see* Sub-thermal Baths). The soothing effect of the baths and the enforced and complete rest, alike of the nerve centres and of the affected organs, are the operative factors.

Another essentially congestive and sometimes gouty condition is met with in rather older subjects towards middle life. Cases of menorrhagia with chronic congestion of the uterus, sometimes with old pelvic exudations and sometimes with commencing fibromyoma, have been for many years treated by salt and brine baths, at Kreuznach, and often with benefit. Similar baths are given at Woodhall Spa. For others, the sulphated alkaline waters and peat baths of Franzensbad give better results.

Spa treatment is often sought for the common sub-acute and catarrhal conditions of the pelvic organs, chronic leucorrhœa and endometritis. Of these sterility is a usual and obvious result. Muriated waters may prove beneficial for such complaints, La Bourboule, Saint Nectaire, Kissingen, Saint Sauveur, Ems. The two last-named spas have acquired some reputation from successful treatment of sterility. A more active resolvent thermal treatment is sometimes helpful, as at Dax and Franzensbad.

(10) **Senile Changes and Traumatism.**—The use of warm baths for the weakness and emaciation of age has been commended from ancient times (Odyss. XXIV.). In atrophic changes and commencing

fibroid degeneration, regulated thermal applications stimulate and equalise the arterial circulation and bring an increased blood supply to ill-nourished parts. Sub-thermal warmth and moisture mollify the tissues and soothe and stimulate the nervous centres. In the old, high temperatures can only be applied locally.

At some of the French and Italian spas, inflammatory thickenings, contractions and adhesions resulting from wounds and injuries, are submitted to a course of thermal treatment. Increased tissue change, which may probably become more active in partially or recently organised tissues than in healthy parts, and the heightened power of absorption from stimulation of the arterial and lymphatic circulations, no doubt explain the good results obtained. Old effusions and adhesions can be treated in the same manner.

(11) **Disorders of the Nervous System.**—The toxæmic conditions underlying peripheral neuritis, alcoholic or otherwise, may be met by a course of eliminative waters (Llandrindod, Harrogate), or by sedative sub-thermal baths (Buxton, Bath), in the early stage, and more stimulant thermal treatment subsequently. Peat baths, as at Strathpeffer and Marienbad, are sometimes helpful. Peat baths and thermal douches and brine baths (Droitwich) are also used for the later stages of sciatica and brachial neuritis. Neurasthenia of an irritable type is often intolerant of waters and especially of hot baths. Only the most sedative baths (Néris, Schlangenbad, Plombières, Bagnères de Bigorre) are admissible. The slighter forms of Graves' disease often benefit by indifferent or salt baths or gaseous baths at comparatively low temperatures. On the other hand a more tonic spa treatment may be used for hysteria and neurasthenia of a more torpid type. Douches—hot, cold, or alternating, and especially the cold spinal douche—and salt or bracing mountain spas, are to be preferred (Llandrindod, Strathpeffer, Buxton, Luchon). Infantile paralyses and old hemiplegias are sometimes successfully treated by prolonged warm baths, as at Néris, together with exercises and massage. The inco-ordination, pains and crises of tabes dorsalis may also be alleviated, and in some cases the disease apparently arrested. At Oeynhausen, in Germany, and the French spas, Lamalon and Bourbon d'Archambault, the bath treatment of tabes is skilfully combined with methodical muscular exercises. Disorders of the vasomotor system are referred to under Circulation.

(12) **Convalescence, Overstrain, Incipient Disease.**—Protracted convalescence, both in young subjects and in later life, may often be assisted by a tonic course of waters, especially at bracing spas. The recurrence of acute rheumatism or influenza is often prevented by a mild eliminative and stimulant treatment

(Strathpeffer, Llandrindod, Homburg, Chatel Guyon). Chalybeate waters and baths are indicated in anæmic conditions (Schwalbach, St. Moritz).

Many persons in middle life under habitual overstrain best maintain average health by an annual resort to the spas of the type just mentioned. Many others, showing signs of incipient nervous, circulatory, or renal disease or various toxæmias, may often by means of appropriate hydrological methods effectually postpone more serious developments.

R. FORTESCUE FOX.

INDEX OF SPAS.

Abano (near Padua), 100 feet, hyperthermal weak salt springs, radio-active, an organic mud (*fango*), applied locally for chronic joint affections.

Acqui (Piedmont), 480 feet, hyperthermal salt sulphur springs, hot *fango* applied in chronic joint and neuralgic affections.

Aix-la-Chapelle (Germany), 530 feet, thermal salt sulphur springs, employed internally and by inhalation in catarrhal conditions, in chronic joint affections and (with mercurial inunctions) in syphilis ; open throughout the year.

Aix-les-Bains (Savoy), 860 feet, thermal waters faintly sulphuretted, mainly used externally for the douche-massage, and for general and local vapour baths in chronic arthritis and gouty and rheumatic affections of the joints and fibrous tissues, neuritis and neuralgia. The strong sulphur water of Challes is used internally at Aix, and sulphur inhalations are given for catarrh at Marlioz.

Amelies-les-Bains (Eastern Pyrenees), 920 feet, hyperthermal alkaline sulphur waters, indicated in chronic arthritis, rheumatism and catarrhal and skin affections ; may be visited in winter.

Argeles-Gazost (near Lourdes), 1,520 feet, cold sulphided waters resembling those of Eaux Bonnes ; a pleasant spa in spring and autumn for nervous and catarrhal affections.

Baden (Switzerland), 1,230 feet, hyperthermal sulphur waters, given in sub-thermal baths for chronic rheumatism, sciatica, etc.

Baden-Baden (Germany), 650 feet, many hyperthermal springs, radio-active, weakly mineralised by chloride of sodium and traces of arsenic, used for drinking and flowing baths, douches, and natural vapour baths, the usual indications for thermal baths, especially for delicate subjects, convalescence and chronic catarrhs ; open all the year, warm in summer, in the vicinity of forests.

Baden-Weiler (Black Forest), 1,400 feet, sub-thermal waters ; "terrain" cure.

Bagnères de Bigorre (Pyrenees), 1,805 feet, thermal calcareous waters, diuretic and tonic, used, with the baths, for their sedative action in irritable and painful nervous conditions, neuralgia and dysmenorrhœa; chalybeate and sulphur waters are employed in anæmia and catarrhal affections.

Bagnoles de l'Orne (Normandy), 530 feet, sub-thermal waters in fine wooded hill country, sub-thermal baths prolonged to 30 or 60 minutes, believed to exercise a tonic action on the surface arterioles and veins, used in convalescence from phlebitis (especially gouty), and in circulatory disorders at the menopause.

Bains-les-Bains (Vosges), 980 feet, a sedative thermal spa among woods, with silicated radio-active waters. The sub-thermal baths are markedly sedative to the nerve centres, and, with the diuretic waters, are employed in vascular hypertension and sclerosis.

Barèges (Pyrenees), 4,300 feet, thermal sulphur waters, unctuous with organic matter (*baregine*), especially valued for their stimulant action in tuberculous affections of bones and joints, chronic rheumatism, the results of wounds and injuries, and in some cases of infantile paralysis.

Bath (Somerset), 100 to 600 feet, *Aquæ Sulis* of the Romans, thermal waters with sulphate of calcium, radio-active, principally used for baths and the massage-douche, inhalations and local vapour baths; a sedative spa for chronic gout, rheumatism and fibrositis, and in circulatory and nervous erythism.

Battaglia (Italy), hyperthermal waters containing a little salt, used for baths and natural vapour baths and inhalations, also *fango*, in gouty and rheumatic affections, and arthritis and chronic catarrh. The treatment is available all the year.

Bex (Switzerland), 1,400 feet, brine baths, beautifully situated in the Rhone Valley, a tonic spa.

Bormio (Italy), 4,500 feet, an alpine spa with thermal waters, immersion baths, douches and mud baths, used for arthritic and chronic skin affections.

Bourbon-Lancy (France), 1,780 feet, weak hyperthermal salt springs, radio-active, with thermal and vapour baths, especially used in rheumatism and nervous erythism.

Bourbon-l'Archambauld (near Moulins), 870 feet, thermal muriated waters, local vapour baths and hyperthermal douches and *pediluvia*, employed in nervous affections, rheumatism, arthritis and scrofula.

Bourbonne-les-Bains (France), 900 feet, hyperthermal salt waters, high pressure douches and sub-thermal and thermal baths a stimulating spa for scrofulous and rheumatic affections and the results of traumatism.

Brides-Salins (Savoy), **Brides-les-Bains**, 1,860 feet, a warm weak salt sulphated water, tonic and laxative, used especially for constipation and congestion and enlargement of the liver and obesity. **Salins-Moutiers**, near by, has a warm radio-active brine with much free gas, employed in "flowing baths" in lymphatic and circulatory disorders; "terrain" cure. **Pralognan** (4,670 feet), is a valuable climatic alpine station in the vicinity.

Bridge of Allan (Scotland), a salt water with chloride of calcium, sometimes used for dyspepsia.

Buxton (Derbyshire), 1,000 feet, sub-thermal water, rich in nitrogen, radio-active, also chalybeates; reclining, douche, peat baths, indicated for chronic rheumatism, gout, nervous affections and anæmia.

Castellammare (Bay of Naples), salt alkaline and iron waters and sea baths.

Cauterets (Pyrenees), 3,200 feet, thermal alkaline sulphur waters, unctuous with silicates and organic matter, radio-active, used internally and for baths, douches, inhalations, gargling, etc., in chronic pharyngeal and respiratory catarrhs, sluggish tubercular lesions, atonic dyspepsia, eczema and nervous dysmenorrhœa.

Ceresole-Reale (Italy), 5,290 feet, a bracing alpine spa with iron and arsenical waters.

Châtel Guyon (Auvergne), 1,300 feet, warm gaseous alkaline waters with a little salt, chloride of magnesium and iron, used internally and for effervescing flowing baths, for atonic nervous and gouty dyspepsia, catarrh of the colon and constipation; a sedative and tonic spa in beautiful country.

Cheltenham (150 feet), cold sulphated salt and chalybeate waters, resorted to for chronic gouty and hepatic disorders, especially by persons from hot countries.

Chianciano (Siena), 1,800 feet, thermal calcareous and diuretic waters.

Contrexéville (Vosges), 1,150 feet, cold calcareous waters, used chiefly internally, very diuretic and slightly laxative, recommended for insufficient renal action, urinary gravel, oxaluria and chronic cystitis, gouty hypertension and atonic dyspepsia.

Cudowa (Silesia), 1,310 feet, cold gaseous alkaline chalybeate waters and effervescent baths, indicated in convalescence, anæmia and cardiac debility.

Dax (near Bayonne), 130 feet, hyperthermal waters, used for baths, douches and vapour baths, local and general, soft siliceous mud baths, unctuous with organic matter ("thermal algæ"), often given at high temperatures for their stimulant, revulsive and resolvent effects in chronic rheumatism and arthritis, in peri-articular thickenings and contractions and in pelvic exudations; a thermal spa, open both summer and winter.

Droitwich (Worcester), a nearly saturated brine, used externally in chronic rheumatism and gouty affections, sciatica and muscular rheumatism, also in some scrofulous conditions and for anæmia and retarded convalescence. The baths are open all the year.

Eaux-Bonnes (Pyrenees), 2,460 feet, a thermal sulphided water, radio-active, used mainly internally, in catarrh of the respiratory passages, anæmia and scrofula; a stimulant spa, with marked intensive action.

Eaux-Chaudes (Pyrenees), 2,050 feet, weak sub-thermal sulphided waters, radio-active, used chiefly for baths and irrigations, for their sedative effect in pelvic and many nervous disorders and subacute rheumatism.

Elster (Saxony), 1,550 feet, cold gaseous alkaline sulphated and chalybeate waters, effervescent iron and peat baths; indications as for Franzensbad; a bracing spa.

Ems (Prussia), 260 feet, thermal salt alkaline effervescing springs, much used internally and as baths, sprays and inhalations for chronic catarrhs, gouty bronchitis and dyspepsia, also with occasional advantage for leucorrhœa.

Evaux-les-Bains (France), 1,500 feet, a thermal water resembling that of Néris, with similar indications, and locally for chronic rheumatism.

Evian-les-Bains (on the Lake of Geneva), 1,240 feet, a feebly alkaline cold water, diuretic; employed with advantage in deficiency of renal action, catarrh of the bladder and in early cases of arterio-sclerosis.

Franzensbad (Bohemia), 1,500 feet, cold effervescing alkaline, sulphated and chalybeate waters, used in anæmia and chlorosis, hepatic dyspepsia and gout, effervescent, moor and gas baths, employed in cardio-vascular and functional nervous disorders, leucorrhœa and affections of the pelvic organs.

Gastein (Austria), 3,430 feet, thermal waters, radio-active, principally used for baths, both thermal and hyperthermal, in painful rheumatic and nervous affections (tabes dorsalis), and for the resolution of exudations, as in pelvic peritonitis; a mountain station, also resorted to for "after-cures."

Hammam-Meskoutine (near Constantine, Algeria), 900 feet, a winter and spring resort in mountainous country, hyperthermal calcareous waters, stimulant and intensive, used externally for chronic rheumatism and sometimes for anæmia and diseases of women.

HAMMAM-R'IRHA (Algiers), 1,800 feet, hyperthermal waters with a fine winter climate, in the neighbourhood of pine woods near the sea; a highly stimulating thermal spa for atonic arthritic and nervous affections, neuralgia and slight paralysis, contra-indicated in congestive conditions.

HARROGATE (Yorkshire), 400 to 600 feet, cold salt sulphur and chalybeate waters, used for their alterative and laxative effect in many congestive and gouty conditions; sulphur, peat, douche, vapour and other baths, much employed in chronic joint affections and "fibrositis."

HELOUAN (near Cairo), a climatic winter resort with sub-thermal salt sulphur waters; the baths are used mainly in chronic rheumatism and arthritis.

HOMBURG (Germany), 600 feet, effervescing salt waters, with chloride of calcium, also salt chalybeate waters, inhalations, salt and effervescent baths; a spa and pleasure resort, for gouty disorders and dyspepsia of a congestive type, catarrhal affections and anæmia and cardiac debility.

ISCHIA, thermal salt alkaline springs (Gurgitello), natural vapour baths and sand baths at Castiglione; available in winter.

ISCHL (Austria), 1,550 feet, a strong brine for baths and salt springs for drinking, mud baths and "terrain" cure.

JOHANNISBAD (Bohemia), 2,070 feet, sub-thermal waters and a chalybeate spring; a bracing station for after-cures and convalescence.

KARLSBAD (Bohemia), 1,230 feet, hyperthermal alkaline sulphated waters with free gas, radio-active; much used for liver affections, dyspepsia, constipation and overfeeding, especially in stout subjects, and in those who have resided in the tropics.

KISSINGEN (Bavaria), 650 feet, effervescing salt waters with chloride of calcium and some carbonate of iron, plain and effervescent salt baths, douches, gas and mud baths, inhalations; the waters are used for catarrhal conditions, dyspepsia and constipation, atonic gout, glycosuria, obesity, also in scrofula and anæmia, and the effervescent baths in circulatory disorders.

KREUZNACH (Germany), 340 feet, salt waters with chloride of calcium and traces of barium, radio-active; a typical salt spa with very mild climate, for drinking, baths and inhalations, largely used for scrofulous and catarrhal affections, especially of the throat and bronchi, and in endometritis and old pelvic cellulitis.

La Bourboule (Auvergne), 2,780 feet, hyperthermal muriated alkaline, arsenical radio-active waters, in a mountain climate, indicated for anæmia, scrofulous and chronic skin affections, prolonged sedative baths and douches, inhalations for chronic mucous catarrhs.

Lamalou (Cevennes), 620 feet, sub-thermal alkaline chalybeate waters and "piscine" baths, employed for chronic rheumatism, neuritis and nervous affections (tabes dorsalis).

Laurvik (Norway), cold sulphurous and chalybeate waters and mud baths, employed especially in rheumatic affections, sciatica and pelvic effusions.

Lavey (Rhone Valley), 1,350 feet, weak thermal sulphur waters, brine and hot sand baths, for atonic scrofulous and rheumatic affections.

Leamington, 200 feet, cold sulphated salt water with sulphate of lime, diuretic and laxative, baths and douches, resorted to for hepatic disorders, dyspepsia, and constipation.

Lenk (Switzerland), 3,630 feet, strong sulphuretted waters with sulphate of lime; indications as for Strathpeffer.

Levico (Tyrol), 1,700 feet, cold sulphate of iron and arsenical waters, used in anæmia and malarial cachexia.

Lisdoonvarna (Ireland), 430 feet, a bracing spa with weak sulphuretted and chalybeate springs, helpful in rheumatic and digestive disorders.

Llandrindod (Wales), 700 feet, salt, sulphur and chalybeate waters, slightly laxative, employed as at Harrogate; a tonic spa, helpful in neurasthenia and debility.

Llangammarch (Brecknockshire), 600 feet, muriated water with chlorides of calcium and barium, a tonic and sedative spa for scrofulous affections, neurasthenia, etc.

Llanwrtyd (Wales), 800 feet, a strong sulphuretted water with indications similar to those of Strathpeffer.

Loeche-les-Bains (Switzerland), 4,600 feet, thermal waters containing sulphate of calcium, sub-thermal baths and douches, prolonged immersion baths at indifferent temperatures, in chronic and intractable eczema and psoriasis, sometimes as a sedative in gouty arterial hypertension and nervous erythism; the alpine climate powerfully modifies the effect of treatment.

Lucan (near Dublin), a weak sulphuretted water.

Lucca (Italy), hyperthermal calcareous springs, thermal vapour and mud baths, intensive treatment for chronic joint affections.

Luchon (France), 2,050 feet, thermal and hyperthermal sulphur waters, used for drinking, baths and inhalations; indications similar to those of Cauterets, but with the warmth of the climate a more intensive treatment; mercurial inunctions as at Aix-la-Chapelle; "terrain" cure.

Luxeuil-les-Bains (near Plombières), 1,300 feet, thermal waters, radio-active, used for sub-thermal baths and hyperthermal rectal and vaginal douches; indications those of Plombières, also chronic endometritis, inflammatory conditions of the uterine appendages, and old pelvic peritonitis, with amenorrhœa or sterility.

Marienbad (Bohemia), 2,090 feet, cold alkaline sulphated springs with free carbonic acid gas, thermal effervescent and moor baths; indications as Karlsbad, also cardio-vascular disorders in gouty and nervous subjects, and chronic uterine affections.

Martigny (Vosges), 1,200 feet, cold calcareous diuretic waters; indications as for Contrexéville; a quiet restful spa.

Matlock Bath (Derbyshire), tepid immersion baths, *fango* and effervescent baths; a sedative station for chronic rheumatic affections, sciatica, and some cases of cardiac and functional nervous disorder.

Moffat (Scotland), 370 feet, weak salt, sulphur and chalybeate waters; recommended with the climate, in rheumatic affections and convalescence.

Monsummano (Italy), sub-thermal waters in large natural caverns, used as vapour baths in lumbago, sciatica, also a tepidarium and douche baths.

Mont Dore (Auvergne), 3,400 feet, a mountain spa; hyperthermal weak alkaline waters with a trace of arsenic; hyperthermal half baths and foot-baths, local treatment by inhalations and sprays in respiratory catarrhs and asthma, especially in gouty subjects.

Montecatini (Italy), 920 feet, a weak sub-thermal salt water, used internally for delicate catarrhal and dyspeptic subjects.

Nenndorff (Prussia), 230 feet, a strong sulphuretted water, sulphureous mud baths.

Néris (France), 1,150 feet, thermal soft, faintly alkaline waters, radio-active, sub-thermal and prolonged baths, with sedative effect in nervous excitation, gastralgia, enteralgia, hysteria and disorders of the pelvic organs, also natural vapour baths; the climate enhances the sedative action.

Neuenahr (Germany), 260 feet, thermal gaseous alkaline waters, often used for gouty glycosuria and dyspepsia; inhalations for chronic catarrhs; a warm and sheltered spa.

Nauheim (Germany), 400 feet, sub-thermal effervescing salt waters, taken internally for catarrhal conditions, dyspepsia and scrofula; baths at sub-thermal temperatures, either plain, salt, effervescent, or strengthened by *mutterlauge;* inhalations for pharyngeal and bronchial catarrhs; the baths are used in chronic rheumatic affections, especially as a tonic treatment in weakness of the heart and circulation, in the latter case often combined with graduated "resisted exercises"; a warm spa.

OEYNHAUSEN (Westphalia), 230 feet, strong sub-thermal effervescing salt waters, principally used for effervescent baths in circulatory and nervous disorders (tabes dorsalis).

PANTICOSA (Spain), 5,600 feet, sub-thermal and sulphur waters, inhalations of nitrogen gas, chronic tuberculosis and catarrhal affections.

PLOMBIÈRES (Vosges), 1,300 feet, thermal and hyperthermal waters, some unctuous from the presence of silicates; radio-active; piscine and thermal baths, underwater douches, Roman Vaporarium, lavage of the large intestine; the waters used internally for their sub-sedative action in nervous dyspepsia and as a diuretic; the thermal baths, aided by the mountain climate, are markedly sedative and employed in painful "arthritic" and nervous disorders, painful spastic conditions of the large bowel, "typhlitis" and chronic colitis, especially when associated with a tendency to diarrhœa, also in cases of appendicitis after operation; the indications also include nervous gastralgia, sciatica, tabetic pains and crises, insomnia, irritable neurasthenia, and spasmodic dysmenorrhœa.

PÖSTYEN (Hungary), 490 feet, hyperthermal sulphur waters, baths and local applications of sulphureous mud, an intensive treatment, used for indolent joint affections, neuralgias and syphilis.

POUGES (France), 650 feet, cold gaseous alkaline calcareous waters, resorted to in many conditions of debility, atonic gout and dyspepsia, anæmia, glycosuria and senility; "terrain" cure; a warm spa.

POZZUOLI and BAGNOLI (near Naples), thermal salt alkaline waters, fumeroles of sulphuretted vapour and natural vapour baths.

PYRMONT (Germany), 420 feet, cold gaseous chalybeate and salt springs, effervescent and "moor" baths; indicated in anæmia and scrofulous affections.

RAGATZ-PFAEFERS (Switzerland), 1,700 feet, sub-thermal indifferent waters, radio-active, prolonged baths; a bracing and sedative spa for painful rheumatic affections and arthritis, irritable nervous conditions, and some chronic skin affections.

REICHENHALL (Bavaria), 1,570 feet, a strong brine (22 per cent. used for inhalations and gaseous and other baths, for catarrh o respiratory organs, etc.; "terrain" cure.

Rheinerz (Silesia), cold gaseous chalybeate waters, effervescent and peat baths ; " terrain " cure ; indicated in anæmia, debility and convalescence.

Rheinfelden (Switzerland), 866 feet, a nearly saturated brine like that of Droitwich, especially useful in scrofula and chronic rheumatism.

Rippoldsau (Black Forest), 1,856 feet, cold gaseous chalybeate waters and iron baths.

Roncegno (Tyrol), 1,750 feet, cold sulphate of iron and arsenical water.

Royat (Auvergne), 1,480 feet, thermal salt alkaline gaseous waters with a little iron, used internally, and for effervescent baths and inhalations, valuable for atonic gouty affections, dyspepsia, eczema, bronchial catarrh and anæmia ; the baths are also employed for their tonic effect in cardio-vascular disorders.

Saint-Armand (near Lille), 100 feet, sub-thermal waters, diuretic ; the siliceous sulphuretted mud baths are unctuous with organic matter ; duration of bath from one to three hours ; also hyper-thermal local applications ; employed in chronic rheumatism and arthritis, sciatica, the results of traumatism and pelvic peritonitis and in old-standing phlebitis and periphlebitis.

Saint Gervais (near Chamounix), 2,075 feet, a sedative mountain spa with warm, weak, sulphated salt waters ; used with advantage internally and for baths, in arthritis and nervous affections, chronic eczema and prurigo.

Saint-Honoré (France), 900 feet, sub-thermal waters containing sulphur and arsenic, used internally and for baths, and locally for the throat and bronchial mucous membrane in young scrofulous subjects and for chronic catarrhs and torpid tuberculous affections in adults.

St. Moritz (Switzerland), 5,800 feet, cold gaseous chalybeate springs, with effervescent baths ; a bracing spa, appropriate in chlorosis, anæmia, debility and atonic conditions.

Saint Nectaire (Auvergne), 2,500 feet, thermal gaseous salt alkaline springs with a little iron ; a tonic spa for rheumatic, gouty anæmic and dyspeptic subjects, with some reputation in functional albuminuria.

Saint Sauveur (Pyrenees) 2,500 feet, sub-thermal unctuous sulphur waters, mainly used for baths in utero-ovarian disorders, and dysmenorrhœa, especially in weakly and nervous subjects, also in irritable neurasthenia and nervous dyspepsia ; a sedative, sheltered mountain spa.

Salies de Béarn (France), 100 feet, a strong brine bath, recommended in scrofulous and torpid uterine affections and fibromyomata.

Salins (Jura Mns., France), 1,200 feet, cold salt waters for baths in scrofula and convalescence.

Salins-Moutiers. *See* Brides les Bains.

Salsomaggiore (Italy), 520 feet, a cold brine (13 per cent.) much used for baths and inhalations in scrofulous, gouty and rheumatic affections.

Sandefjord (Norway), gaseous salt sulphur and sulphate of iron springs, hot salt and mud baths; indications as for Laurvik.

Schinznach (Switzerland), 1,140 feet, strong sub-thermal sulphuretted waters with baths, douches and sprays, employed especially in skin affections and catarrhs, also in rheumatism, scrofula and syphilis.

Schlangenbad (Germany), 900 feet, a soft sub-thermal water, rich in gases; a restful and sedative spa, valuable for retarded convalescence, nervous erythism and overstrain and neurasthenia, and some chronic skin affections.

Schwalbach (Germany), 950 feet, cold gaseous chalybeate water; peat and effervescing iron baths; indications as for Spa.

Soden (Taunus, Germany), 450 feet, warm salt waters, some gaseous, used internally and by inhalation and gargling for catarrhal affections, scrofula and convalescence; circulatory disorders are treated by gaseous baths.

Spa (Belgium), 1,000 feet, cold gaseous chalybeate effervescent iron and moor baths; indications, anæmic and atonic conditions, especially in women, with leucorrhœa, menorrhagia, or sterility, in convalescence and circulatory disorders.

Strathpeffer (Scotland), 150 to 300 feet, strong sulphuretted and chalybeate waters, sulphur, peat, douche and artificial effervescing baths; resorted to for chronic gout and rheumatism and skin affections (gouty eczema); both the climate and baths are helpful in neurasthenia, insomnia, and in the debility of age; a tonic and sedative spa.

Tarasp-Schuls (Switzerland), 3,890 feet, cold muriated effervescing strongly alkaline waters, used in dyspepsia, glycosuria and constipation of plethoric subjects; salt and effervescent baths in cardio-vascular disorders; also a chalybeate and arsenical spring in anæmia; a bracing spa.

Teplitz (Bohemia), 730 feet, thermal waters with thermal and peat baths, used in rheumatic, gouty and functional nervous disorders.

Tunbridge Wells, 430 feet, cold chalybeate waters, helpful in many cases of anæmia and convalescence.

Uriage (France), 1,350 feet, a sub-thermal salt sulphur spring, isotonic, laxative, diuretic, prolonged baths, and local irrigations and inhalations, recommended for scrofulous and delicate children, impetigo, eczema and psoriasis, and used as an adjuvant treatment in syphilis.

Vals (France), 790 feet, many cold alkaline waters with a little iron and free carbonic acid gas, slightly laxative, diuretic and cholagogue; more stimulating than Vichy, used for atonic dyspepsia and gouty affections.

Vernet-les-Bains (France), 2,060 feet, soft unctuous thermal sulphur waters; indications those of Cauterets, also as an adjuvant treatment in syphilis; open throughout the year.

Vichy (France), 736 feet, many cold and thermal strongly alkaline waters, also traces of iron, arsenic, and fluorine, and free carbonic acid gas; nearly isotonic; employed for drinking and for many kinds of baths; given especially for hepatic dyspepsia, gallstones and jaundice, gouty glycosuria, hyperacidity and obesity; contra-indicated in thin and weakly subjects.

Vinadio (Piedmont), 4,360 feet, thermal salt sulphur waters and a series of vapour baths (*stufe*) in ascending order of temperature, hyperthermal mud baths (*fango*).

Vittel (Vosges), 1,100 feet, a cold calcareous and diuretic water; indications those of Contrexéville; a modern spa and pleasure resort.

Weilbach (Germany), 440 feet, cold sulphuretted and weak alkaline waters, with reputation in liver affections.

Wiesbaden (Germany), 380 feet, thermal salt waters, radio-active; thermal and hyperthermal baths, douches and inhalations; a valuable spa, warm in summer, but open throughout the year, situated in the vicinity of forests; helpful in atonic gout and intestinal catarrh, uterine disorders, and catarrhs of the respiratory passages, also for the inunction treatment of syphilis and systematic exercises in nervous diseases.

Wildbad (Black Forest), 1,410 feet, thermal waters, rich in nitrogen gas; flowing baths, douches and vapour baths; besides rheumatism and gout, conditions of nervous erythism and weakness, convalescence and premature senility.

Wildungen (Germany), 980 feet, alkaline calcareous gaseous water, also a chalybeate, powerfully diuretic; used in urinary lithiasis and genito-urinary catarrh; stimulating sub-thermal baths.

Woodhall Spa (Lincolnshire), salt waters with chloride of calcium and a small quantity of bromide; the baths, like those of Kreuznach, are used in scrofula, leucorrhœa, and for their decongestive effect in uterine fibroids, also in rheumatic affections and arthritis; the comparatively bracing east coast climate is a factor in the treatment.

Yverdon (Switzerland), 1,430 feet, warm sulphur water, used for drinking, baths and inhalations; also *fango* and sun baths; indications those of Cauterets.

R. FORTESCUE FOX.

Note.—The writer desires to record his indebtedness to Sir Hermann and Dr. Parkes Weber's invaluable work, "Climatotherapy and Balneotherapy," 1907; and would also refer the reader to "Crénothérapie, Climatothérapie et Thalassothérapie," by Landouzy and others, Paris, 1910, the "Deutsches Bäder-Buch," 1907, and Prof. Winternitz on "Hydrotherapy" in Solis Cohen's "System of Physiologic Therapeutics," 1902, Vol. IX.

HYPNOTISM AND TREATMENT BY SUGGESTION.

Brief Historical Introduction.—What was known as animal magnetism is nearly as old as the world. But it was a Viennese doctor, Mesmer by name (1734—1815), who first introduced it to European civilisation as a definite science full of therapeutic possibilities. His theory was that hypnosis was induced by the action of a mysterious force or fluid emanating from the operator, and he and his followers used various physical means, such as metal plates, passes with contact, or fixing the patient's gaze on a bright object, to obtain their results. His course of procedure was then called mesmerism.

J. M. Elliotson, apparently the first English medical man to practise mesmerism, was born in 1791. He was M.D. of Edinburgh and had visited the most important Continental medical schools. He became Professor of Medicine at University College, and whilst there was greatly interested in mesmerism, introducing it into most of his lectures. He made many experiments at University College Hospital, an institution which he had been the chief means of founding, but he met with so much opposition from his *confrères* that he was obliged to resign his appointment. In 1838 the Council of University College requested their committee to take steps to prevent the practice of mesmerism or animal magnetism in the hospital. Elliotson, its senior physician, felt this insult keenly. He argued that the action of the Council was unreasonable, as most of the members had refused to witness his experiments or discuss the matter with him.

In 1846 Elliotson delivered the Harveian Oration, and made mesmerism the subject of his address. The *Lancet* attacked him, and said his oration would strike a vital blow at legitimate medicine. But, in spite of his enemies, Elliotson had many sympathisers, some of whom started a paper called the *Zoist*, a quarterly journal for the collection and diffusion of the knowledge of cerebral physiology and mesmerism. Through the influence of the *Zoist*, a mesmeric infirmary was opened in London, and mesmeric institutions founded in Edinburgh, Dublin, etc. In one of these, at Exeter, Parker, a surgeon, is said to have mesmerised 1,200 persons and performed 200 painless surgical operations. In Nottinghamshire, a surgeon, called Ward, amputated a thigh under mesmerism, the patient remaining perfectly calm during th operation and not moving a muscle.

James Esdaile was another pioneer. He was born in 1808 took his degree in 1830, and then obtained an appointment in the East India Company. He made his first experiment in mesmerism in 1845, his subject being a Hindoo suffering from double hydrocele, and he at once succeeded in throwing the man into a deep sleep, and then operated. At the end of the same year he had operated on over 100 patients under mesmeric influence. He reported his successes to the Government, and in 1846 they placed a small experimental hospital in Calcutta at his disposal so that he might extend his investigations as to the applicability of this alleged agency to all kinds of cases, medical as well as surgical, amongst both European and native patients. The following official visitors were appointed: R. Thompson, M.D., J. Mowatt, M.D., D. Stewart, M.D., R. O'Shaughnessy, F.R.C.S., and J. Jackson, F.R.C.S.

Esdaile was as successful at the hospital as he had been elsewhere, and the medical visitors officially appointed by the Government reported that mesmerism caused complete insensibility to pain in the most severe operations and that it reduced shock. Before leaving India he had performed 300 capital operations under mesmerism, including nineteen amputations, one lithotomy, and numerous ablations of enormous scrotal tumours. The mortality was low, being only 5 per cent. in 161 consecutive cases. When he first started mesmeric treatment he used to mesmerise the patients himself, but later on he instructed the native hospital assistants and left this work to them. Esdaile was constantly attacked by the Indian medical journals and described as an honest fool deceived by his patients, who were impostors. His reply to these attacks was that, since using mesmerism, he had done more operations in a month than were performed at the other hospitals of Calcutta in a year; that his patients, operated on under the mesmeric trance, showed no signs of pain, and did not develop the characteristic changes in the pulse and pupils which appeared during operations performed in the usual manner of that period (namely, without anæsthetics), whilst, at the same time, such patients operated on in the usual way always suffered acutely.

James Braid was an English surgeon, born in 1795, and educated at Edinburgh. He started hypnotism or mesmerism in 1841. Braid made numerous experiments and convinced himself that the phenomena he had witnessed were purely subjective and due neither to magnetic fluid nor trickery. In 1842 he wrote a paper on hypnotism, which he offered to the British Medical

Association. They rejected it, whereupon he issued invitations to a conversazione, which was attended by many members of the Association. He then read his paper, showing cases. In 1843 he published "Neurypnology, or The Rationale of Nervous Sleep." In some ways it is unfortunate that this is his best known work, for his later theories differed widely from his earlier ones. In this book he placed his results and methods before his medical brethren, insisting that they only should use hypnotism, and warning the ignorant against tampering with a powerful agency which might produce good or evil according to the manner in which it was applied. He also stated that hypnotism was capable of healing many disorders which formerly were considered incurable. He begged his professional *confrères* to investigate the subject thoroughly and to endeavour to arrive at the truth. Having been a sceptic himself he could make allowance for others.

Braid published a great many works, several of which were subsequently translated into French, and had much influence in interesting French medical men in this form of treatment.

Liébeault was born in 1823 and qualified in 1850. He began to study mesmerism in 1860, after reading a book on "Animal Magnetism." His practice lay chiefly among the poor, whom he treated free of charge, working for many years without much recognition, but with great success. In 1882 Bernheim, having heard that Liébeault had cured an obstinate case of sciatica of six years duration which he himself had treated in vain for six months, went to see Liébeault and his work, and although at first sceptical, he became convinced of the genuineness of Liébeault's methods and became his friend and pupil. A few years later, Bernheim had hypnotised about 10,000 patients and published a book on the subject, which he called "La Thérapeutique Suggestive." In it he said he had been successful in 85 per cent. of his cases. Through Bernheim's book, Liébeault became known throughout the world and many medical men from all nations made a pilgrimage to Nancy to see for themselves the work being carried on there by these two men.

At the same time there was another school of hypnotism at the Salpétrière Hospital, Paris, of which Charcot was the leading light. The methods of these two schools were very different, Charcot only supplied his treatment in selected cases, chiefly hysterical, and his methods resembled those of Mesmer; whilst at Nancy, all kinds of medical cases were treated and the method employed was that of suggestion. Charcot first of all used metal discs, so-called metallo-therapy, but afterwards he discarded them; he also used magnets as the old mesmerists did. He maintained that magnetism or hypnotism was an induced neurosis, that only hysterical patients could be hypnotised, and that suggestion played no part in producing hypnosis, which he considered was due entirely to nerve shock, such as would be caused by a light suddenly flashed into the patient's eyes or the sounding of an unexpected gong.

My attention was drawn to this subject by an article in the Journal of Mental Science, October, 1892, written by Dr. Robertson. I also attended demonstrations given by Drs. Lloyd-Tuckey, Milne-Bramwell and Hamilton Osgood, of Boston. At that time I was medical superintendent of an asylum having 280 beds, and commenced experiments with good results; since then I have treated nearly 3,000 cases.

My first experiments were amongst the insane. People suffering from mental disturbances are very difficult to hypnotise, but by exercising great patience, I was able to influence a good many of them. I have even sat in a padded room with a patient suffering from acute mania and succeeded in quieting him and, in the end, have induced sleep. In a case of delirium tremens, I hypnotised the patient in about a quarter of an hour; he slept for twenty-two hours, then woke up apparently well. When I first entered his room men were holding him down on the bed, whilst he tried to pull the bedclothes over himself, thinking he was putting on his trousers to go out. This patient was a publican, and, although he was obliged to spend most of each day in the bar, he adopted my suggestion against alcohol, and did not touch a drop for six months after the treatment.

It is well to remember that although previous consent is not indispensable to the induction of hypnosis, some persons are refractory who really wish to be hypnotised.

Many patients who are afraid of hypnotism, although it is probably the best treatment for them, can be made to hypnotise themselves with very little training.

For the study and practice of the hypnotic mode of treatment a great deal of patience is required.

Perseverance must be the motto of the operator, and in the end success will be his reward.

The English being very conservative in most of their ideas, have taken a long time to recognise this form of treatment. Popular literature on the subject and the stage exhibitions given in travelling shows, music halls, etc., have also done much to prejudice the public. Now, however, hypnotism is an accepted form of treatment, and a society, called the Psycho-Medical, has been established, whose list of members is increasing daily.

METHODS OF INDUCING HYPNOTISM.

Mesmer's Method.—Mesmer's method included passes with contact, as illustrated by the fact that he would sometimes place his hands on the shoulders of the patient, and work down to the finger tips, his hands holding the thumbs a moment before repeating the process. He used either his fingers or the palm of his hand, and in all cases followed the direction of the nerves as closely as possible. At other times he would lay his hand on the part affected, while sitting opposite the patient knee to knee, fixing him steadily with his eye.

At the very beginning of his experiments he had tried applying magnetised metal plates to the patient's limbs, but these he very soon discarded in favour of personal contact and magnetism. Later on his practice increased to such an extent that it became necessary to evolve a method of treating numbers of people together. It was then that he invented his famous *bacquet.* This was an oaken tub placed in the centre of a dimly-lighted apartment, and it was filled with iron filings, pounded glass, and bottles of "magnetised water," *i.e.*, water which he himself had magnetised with passes. Numerous movable polished rods, bent nearly at right angles, pierced the cover of the tub, and each patient applied one of them to the seat of his disease, a cord passing round all the patients, which united them to each other in a circle. When this was complete, an outer circle was formed by placing the thumb of one patient between the thumb and forefinger of the next. Music was played in a corner of the room, the melody varying with the various movements of the patients, and sometimes singing was introduced to deepen the impression. While this was going on, Mesmer walked through the crowds holding in his hand a metallic rod, with which he touched each patient at the supposed seat of the disease.

Esdaile's Method.—Mesmer was succeeded by many operators who believed they were following in his steps by using passes without contact. But the two methods are essentially different. Esdaile, for instance, had the patient put to bed in a darkened room, breathed gently on his head and eyes for an hour, and made passes without contact over the whole body. At the end of that time the patient was generally found to be insensible to the pain of an operation.

Braid's Method.—Braid was the first to call mesmerism "hypnotism." He began by considering physical aids indispensable for the induction of hypnotic sleep. He held a bright object above the patient's head, bidding him fix his eyes and attention upon it, although this entailed much strain, and was not infrequently followed by slight conjunctivitis. Then Braid drew his middle and forefingers from the object to the patient's eyes, and continued this movement until the eyelids closed. This method very rarely failed, and the limbs usually remained in the position in which they were placed, but if not, Braid told the patient to keep them fixed and was invariably obeyed. His success with blind patients, however, convinced him that physical means were unnecessary for the attainment of his object. The complete quiescence of body and mind was all he needed to help him in his work, and he found that repeated hypnoses increased susceptibility. It would be useless, he declared, to try and hypnotise anyone who was unaware of his intention, because hypnosis was so much more easily induced in persons who were expecting it, and who were, therefore, consciously falling in with the operator's wishes. Braid's final opinion was that physical means might act as indirect suggestions, but would depend for their success on the impression they made on the mind; whereas direct verbal suggestion ensured the induction of hypnosis and the evocation of its phenomena.

Liébeault's Method.—Liébeault's method was simply to place the patient in an arm-chair, telling him to think of nothing and fix his gaze on the operator. Once the attention was arrested, however, he bade the patient close the eyes, and then suggested that the limbs were becoming numb or the eyelids heavy—and in a very short time placed his hand on the patient's body and suggested the sensation of local warmth.

Bernheim's Method.—Bernheim's method was to attract the patient's absolute attention and to insist on his thinking intently of sleep. He was generally successful in inducing hypnosis almost immediately, but if repeated suggestion failed to produce the condition he assured the patient that the hypnotic influence would work as satisfactorily without the aid of sleep.

Beaunis' Method.—Beaunis employs the method of fixed gazing, which he declares to be the best way of inducing sleep.

Wetterstrand's Method.—Wetterstrand employed passes with contact. He insisted on an environment of subdued light and complete silence, and went round the rooms from one patient to another, whispering his suggestions, after having first induced the hypnotic sleep. This method is also closely adhered to by Drs. van Eeder and van Renterghem.

Charles Richet's Method.—Richet did not consider fixed gazing necessary for the induction of hypnosis. His usual method was to make passes downwards in front of the eyes as though endeavouring to close them, after having sat for some minutes in front of the patient, squeezing the latter's thumbs with some force and sustained pressure.

Luy's Method.—This was adaptation of the lure employed by birdcatchers, and consisted of making his patients gaze at a revolving mirror.

Voisin's Method.—Voisin did not stop at the ordinary methods. He sometimes induced hypnosis in violent insane persons. Attendants held these patients, who were obliged to gaze at the Doctor's finger or at a magnesian lamp. After a protracted struggle a deep sleep was attained in successful cases.

Bramwell's Methods.—Dr. Milne Bramwell's methods are many and various. He began by making use of the movable mirror and suggestions, and of passes without contact over the face and upper parts of the body. For some time he worked exclusively on patients in his own practice, and chiefly for purposes of operation only. So successful with them did he become that he was soon able to discard mechanical aids. But in 1890, after the hypnotic demonstration in Leeds, he became sought after by all sorts and conditions of persons, most of whom were total strangers to him. It was then his difficulties began. The new *clientèle* were nearly all suffering from acute nervous disorders, frequently of long standing. It was necessary to adapt the environment to the temperament of these neurotics, and Bramwell was not able to treat them, in groups, as was formerly his method with his old patients. Each had to be taken separately, and even then many methods had sometimes to be attempted before success crowned his efforts. A darkened room, the revolving mirror, and verbal suggestion were again in requisition, and with the help of these he could hypnotise about 75 per cent. of his patients. Then little by little he abandoned physical means and reduced his method to the following:

At the first interview he would confine himself to a careful study of the patient's case and temperament, taking care to remove as far as possible any prejudice against hypnosis the patient might entertain. Then placing him in a comfortable chair, Bramwell asked him to look at his eyes, making twofold suggestions—first as to the sensations he was probably feeling, and secondly as to those the operator wished him to feel.

No special effort to induce hypnosis was made at the first *séance*, but in some cases the first stage of hypnosis was achieved without trouble. Bramwell always suited his methods to the special needs of each case, and was ever careful to gain the intelligent and willing co-operation of his patient. Since then, however, he has developed another and quite a new method of treatment which excludes hypnotism.

He tells the patient to think of a restful mental picture, something which has power to hold his interest, and not to pay any attention to the suggestions given by the operator. Dr. Bramwell then makes two suggestions, one being that each time the patient is treated he will find it easier to rest, and to concentrate his attention on the mental picture; the second suggestion is curative.

Dubois' Method.—Dubois objects to hypnotism or even to the term "suggestion" being applied to his work. He makes a searching diagnosis of his patient's psychical and physical conditions; then, by reasoning with him, he tries to convince him that his case is curable, and that he will get well. Each time he sees the patient he repeats his optimistic suggestion.

The Writer's Method.—When I commenced this mode of treatment I, like many others, employed mechanical agents, such as revolving mirrors, to induce hypnosis, but I soon abandoned these. Respecting the method I now use, a full description together with an explanation of the *rationale* of hypnotism is given in the "Journal of Mental Science" for 1897. It remains much the same to-day as it was then, but I ought, perhaps, to say that I am more than ever convinced of the correctness of John Hunter's observations with regard to "the direct sympathy that exists between the stomach and the most remote organs of the body, and the way in which it may reciprocally affect, and be affected by, the head"; and, acting on this conviction, it is a common practice with me to place one hand on the patient's epigastrium, while gently stroking with the other the patient's head. In this way I am often able to obtain striking results, more especially in palpitation and in epigastric pain, oppression or spasm. While applying the hands in the manner just described, I engage the patient in conversation, with the object of securing his full confidence; I then get him to relax his muscles to the utmost, and insist on complete silence, the only sound heard being that of the rhythmic movement of my hand as I stroke the upper part of the face, or, as sometimes happens, the arms. This silence I have found in many cases more impressive than words, and a suggestion made at the end of a pause of this sort is, in my experience, far more effective than the uninterrupted drone of a voice making the same suggestion in different phrases, as is the custom of Bernheim, who, like myself, resorts to treatment by suggestion without hypnosis. All this time I remain myself as reposeful as possible; I seek, in fact, to create an atmosphere of repose and silence, which is in itself impressive, and tends to induce a feeling of well-being and expectancy in the patient. If, when the psychological moment has arrived, I make a suggestion, I get an effect such as I cannot so readily obtain in any other way, save by inducing actual hypnosis, which many patients object to, and for which there is, in the majority of cases, no necessity whatever.

I would emphasise this fact, that, in most instances, there is no need whatever to send the patient to sleep. Suggestions can, nearly always, be made quite as effectually without hypnosis as with it, and certainly with many of those patients whom it would be impossible to hypnotise. A further advantage of this plan is that treatment can often be carried out in *séances* of quite short duration and in one's consulting room, though, with difficult patients, it may be advisable to visit them at their own houses in the evening, at the hour of natural sleep; in still more obstinate cases we may find it necessary to isolate our patients, so that they may be removed from home influences inimical to the treatment.

With regard to the suggestion, which is the essential curative agent, there must be no kind of uncertainty about the manner of making it. It must be forcible, deliberate, unmistakable. John Hunter says, "A fixed principle fixes the mind, but a doubtful one leaves it no rest." He goes on to say, "Anxiety is expressive of the union of two passions, desire and fear." In the patient's mind the desire is to get well, the fear is that many kinds of treatment having already failed, this one will fail also. The suggestion must therefore be made in such a way as to give the patient confidence both in the physician himself and in his methods. The patient's desire to be restored to health must be accentuated, and any doubt that this will not be accomplished must be dispelled. But before the physician can speak with this necessary authority he must gauge the exact condition of his patient, and must be inspired with confidence in his powers, so that he may imbue his patient with a similar belief. It is this very confidence, or arrogant pretence of it, which enables the blatant charlatan often to succeed where the legitimate but more modest and hesitating practitioner may fail; for, though the latter may begin by feeling pretty sure of success, doubts are almost certain to crowd up in his mind, the strange vagaries of disease, and the unexpected turns it may take, the infinite variety of constitution and temperament that is encountered, the manifold outside influences that may operate antagonistically, especially in the case of the neurotic; all these considerations rise up to disconcert him and rob him of that very confidence which is so necessary to success in inducing hypnosis or in making an effective suggestion. I find, surprising it may seem, that more confidence and experience are required to implant an effective suggestion independently of hypnosis than are required to induce the hypnosis itself, and I am therefore in the habit of advising those beginning the study of treatment by suggestion, always to seek to produce complete hypnosis before offering the therapeutic suggestion, later to practise Bernheim's method of constantly repeating the suggestion without first inducing hypnosis, gradually feeling their way towards the more simple method I have described.

Having trained myself in an asylum, it is perhaps not unnatural that it should seem to me that such a place is the most suitable one in which to cultivate the art of psycho-therapeusis, and for the following reasons. You there learn to deal with people with whom it is impossible to reason; they follow you to a certain point, or for a certain time, and then their attention wanders, and you feel you are no longer holding them, and by degrees you come to see that there is no use arguing with the insane, and for the matter of that, hardly even with the neurotic. They need to be dealt with in other ways. You notice that while one attendant has little or no difficulty in handling the patients under his charge, another is far less successful; you notice why, and try to cultivate his methods. In this way you get to learn that much tact is required to cope successfully with mental cases, more indeed than with persons in the full possession of their faculties. You soon discover that all patients cannot be treated on the same stereotyped lines, that what soothes and gives confidence to one alarms and disquiets another; you gradually come to find that your nervous and mental patients have to be approached with the utmost caution and tact, and to recognise the unwisdom of taking up any decisive attitude towards them until you have first succeeded in understanding them. You get, in short, to understand and to be able to control the most difficult of all persons—those who have no control over themselves, and not the least important thing you learn is endless patience. You learn, in fact, how to adapt yourself to the patient's condition, and what forms your suggestion should take, and thus in course of time you come to act instinctively. I myself probably never treat two patients exactly alike, and, indeed, have no notion how I am going to treat a patient until I feel myself in touch with him. Even then my procedure is rather an instinctive one than one which is consciously reasoned out, so that I should often find it difficult to explain the *raison d'être* of my method in individual cases. Frequently, indeed, while treating a patient, I find myself following out a train of thought having nothing to do with the case in hand, a circumstance which makes my work far less fatiguing than would otherwise be the case.

When I treat a patient I cannot tell at once whether he is susceptible or not, and I often find that patients with whom I can do little at first, on account of a certain anxious nervousness, respond after a few *séances.*

In my opinion every physician, no matter what branch of disease he is called upon to treat, should get all the help he can from suggestion. He should carry as much optimism as he dare into his treatment, and should inspire the patient with the idea that a cure will result; or, if this is not possible, that he is likely to derive substantial benefit from the treatment. And just as the general physician should make all the use he can of suggestion, so, contrariwise, the physician who devotes himself especially to this line of treatment should be prepared to make full use of other therapeutic methods besides suggestion, if he considers they may prove beneficial. To rely in every case upon suggestion, to the exclusion of all other methods, is to credit that method with powers to which it cannot legitimately lay claim. It is true that I myself treat many cases, possibly the majority, by suggestion alone, but this is because in most of my cases all the good that can be got by customary methods has already been obtained; but when this is not so I never hesitate to employ ordinary methods in conjunction with suggestion. Thus, if a patient with chlorosis comes to me, I of course give iron; if there is neuralgia from gummatous formation, I prescribe large doses of iodide; if there is chronic gastro-enteritis, I do not hesitate to put the patient upon a careful dietary; or, again, if the patient is profoundly emaciated, I may find it necessary to resort to the Weir-Mitchell treatment. But in all these methods of treatment I find I get great help from suggestion. In a Weir-Mitchell case, for instance, much can be done by suggestion to calm a restive patient, to improve sleep and digestion and to remove such disagreeable symptoms as neuralgia and headache. In these cases I sometimes find it necessary to see the patient daily, but in the majority two or three times a week suffices, later a single weekly visit may be sufficient. Here let me emphasise the importance of securing the services of the right kind of nurse in carrying out the rest cure. She must be tactful, resourceful, gentle, firm, quiet and patient, a combination of qualities possessed, I need scarcely say, by few.

The disorders in which the best results are obtained by suggestion are, of course, those depending upon functional disturbances of the nervous system, such as tremor, chorea, neuralgia, headache, sleeplessness, palpitation, epilepsy, mental diseases, chronic alcoholism, and the various drug habits (*see* appended list of cases). But, as I have already said, suggestion may prove of service in the treatment of most maladies, and I have, by its means, been able to alleviate serious organic diseases, such as valvular disease of the heart, Graves' disease, and locomotor ataxy. It is, of course, needful to tell the patient in all such cases that absolute cure cannot be effected.

In illustration of my methods I quote a few cases:

Case I.—A. L. D., female, single, aged 24.—Suffered from *facial neuralgia* for four years. No medicine relieved her for more than a few days. She could not sleep and was weak and depressed. Hypnotised for the first time October 7th, 1892, and suggestions given that she was to sleep for fifteen minutes, to awake with no pain, to be bright and cheerful, and to sleep well at night. Everything happened as suggested. The patient awoke, laughing, without any pains, slept well at night, the neuralgia not returning until twelve days afterwards, when she was again hypnotised; since then with the exception of a few hours' pain, due to a carious tooth, during November, 1895, there has been no recurrence of pain.

Case II.—Mrs. F., aged 36.—Consulted me in the summer of 1897 for *sciatica* in the right leg, saying she had been laid up on and off for about eight months and that the pain was at times very acute. When I saw her she limped and was obliged to support herself with sticks on account of the intense pain. She had been treated, without relief, during the whole of her illness by rest, diet, liniments, baths, blisters, poultices, fomentations, etc.

I treated her by suggestion only, placing my hand very gently on the back of her hip outside her dress, when she immediately expressed herself as free from pain. This was the quickest result I have had, and surprised no one more than myself. I told the patient to lie on the couch for half an hour afterwards and then to get up. There was no return of the pain at the end of this time. On leaving me she laughed and said, "I dare say you think I am a fraud, but I assure you I have suffered tortures." She came again three days afterwards, expressed herself as feeling well; she had not experienced any appreciable pain, but the leg was a little weak. In 1902 I saw this lady again for other troubles, but she had kept entirely free of sciatica.

Case III.—Mrs. D. F., aged 34, suffering from *melancholia*, consulted me during the summer of 1901, declaring that she intended to commit suicide unless I could relieve her, and she showed me a bottle of laudanum which she had in her bag for the purpose, she stated. She could give me no cause, domestic or otherwise, for her illness, but complained of insomnia, of great restlessness, and of being easily worried. I found nothing physically wrong, except that she suffered from palpitation and sometimes had neuralgia. She was well nourished. I then proceeded to treat her, and told her that she would soon feel cheerful, that she was to sit in my arm-chair, relax her muscles, close her eyes and give me the bottle of laudanum, which she did. I then placed one of my hands on her epigastrium and with the other stroked her forehead. In about a quarter of an hour the pulse dropped to 72, having been 102, and she became drowsy. I then told her to try and sleep for a few minutes while I went into the next room. This she did, and when I awoke her she began to laugh and said she felt much better, in fact very well. I saw this patient at intervals for about two months, and she made a complete recovery.

Case IV.—Mr. B., aged 21, consulted me in October, 1895, for *rheumatic pains* in all his joints. I treated him by suggestion and gentle manipulations of each joint, and in about half an hour all his pains departed. I saw him once only, and, twelve months afterwards, I heard that he had kept well.

Case V.—Mr. C. A. P. M., aged 34, had *sciatica* of left leg for eighteen months and had been treated at home and abroad during the whole period of his illness. He came to me in 1896, saying that he could not sleep or walk a hundred yards without acute pain. I treated him by suggestion, pressed my fingers outside his clothes, on the painful spots, and gently stroked his leg from above downwards. In about ten minutes all pain vanished, and he performed various gymnastic feats in order to see if the pain would return, but it did not. At the same time he told me that he did not believe in me or my treatment, but he meant to give every one a trial until he got relief. He walked up and down my room for about an hour, doing all sorts of movements, and then went for a brisk two-mile walk, and in two days I had a letter from him saying that he felt a little tired after walking, but the pain had not returned. He visited me two or three times after this to show how well he had kept since the treatment.

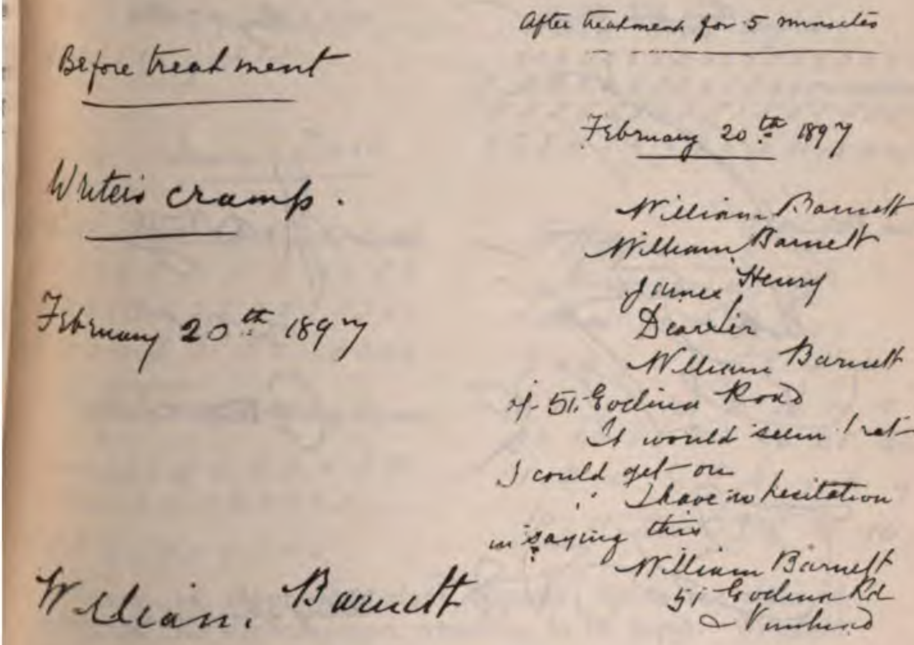
Case VI.—Miss J., aged 37, was sent to me by Dr. Ferrier, from the National Hospital for Paralysis, etc., for *functional paralysis* of left leg. She had been under treatment for two years; her leg was wasted and cold and she walked on crutches, dragging the foot. She could not put her weight on it. I treated her by suggestion only, three times in one week, and she was able to walk after the third treatment. First treatment: I suggested that her leg should feel warm and comfortable; it became warm in a quarter of an hour. Second treatment: I suggested that she should be able to move it, which she did slightly in ten minutes. Third treatment: That she should be able to stand on it and walk, which she did in half an hour, but only with great difficulty on account of the weakness. Afterwards she steadily improved; in about a month the leg was the same size as the other, and she walked then as if she had never been ill.

Case VII.—M. A. F., aged 60, married, consulted me on November 9th, 1901, complaining of *constant pain* in her right leg, extending from the knee to the ankle on the outer side. The pain had lasted for six months and nothing gave her relief. No cause for the pain could be ascertained. Patient had recently undergone a rest cure (Weir-Mitchell), and had had treatment for gouty dyspepsia and neurasthenia, and expressed herself as feeling well, except for the pain in her leg. I treated her by suggestion only, saying that the pain would go, placing my hands where the leg was painful. In about ten minutes she told me that every vestige of pain had disappeared, and she walked with comfort about the room. I saw this lady last summer, and she told me that she had had no pain in her leg since I treated her. One treatment was sufficient.

Case VIII.—Mr. A., aged 28, was sent to me in the summer of 1898, from Enfield, by his doctor, suffering from *pain in the head* after an attack of influenza. Drugs had afforded him no relief. He had endured the pain about fifteen months, was very depressed in consequence, and inclined to suicide. I treated him for about half an hour by suggestion, with slight hypnosis, at the same time gently pressing his head with both hands. When I told him to open his eyes he expressed himself as feeling quite well, and said that all the pain had gone, that his head, which was heavy and painful before, was now light and comfortable. He left me in a cheerful mood and remained well for some considerable time. He then had a slight return of the pain. I treated him again the same year; since then he has kept quite well.

Case IX—Miss M., aged 45.—A patient of Dr. Cole, sent me by Dr. Darwall Smith on July 6th, 1910, suffering from *melancholia*, with the usual depression and morbid ideas—as for instance, that she was different from everyone else, could never get well, there was no hope for her, and she could take no interest in anything. I treated her once on July 6th in the manner described. She did not go to sleep but remained passive whilst resting in the arm-chair. She began to improve at once and after the second treatment, on July 12th, she recovered and has since remained well.

Case X.—Mrs. A. K. M., aged 28, had been in a state of *puerperal mania* for six months before she was treated at Hoxton House in 1893. She had been shrieking continuously for five days and nights whilst at the Infirmary, and was raving when admitted. I told the nurses to place her in the arm-chair in my office, and to wait in an adjoining room. I then started to hypnotise the patient, and, although she did not sleep, she became perfectly quiet, and did not speak again for eight hours. I hypnotised her altogether seven times, always during the day, with the usual suggestions for good sleep at night, etc. She made an uninterrupted recovery. So rapidly did this case respond to treatment that the nurses, not hearing her voice as they left the room, peeped round the door and asked the relieving officer if I had gagged the patient.



Before treatment

Writer's cramp.

February 20th 1897

William. Barnett

After treatment for 5 minutes

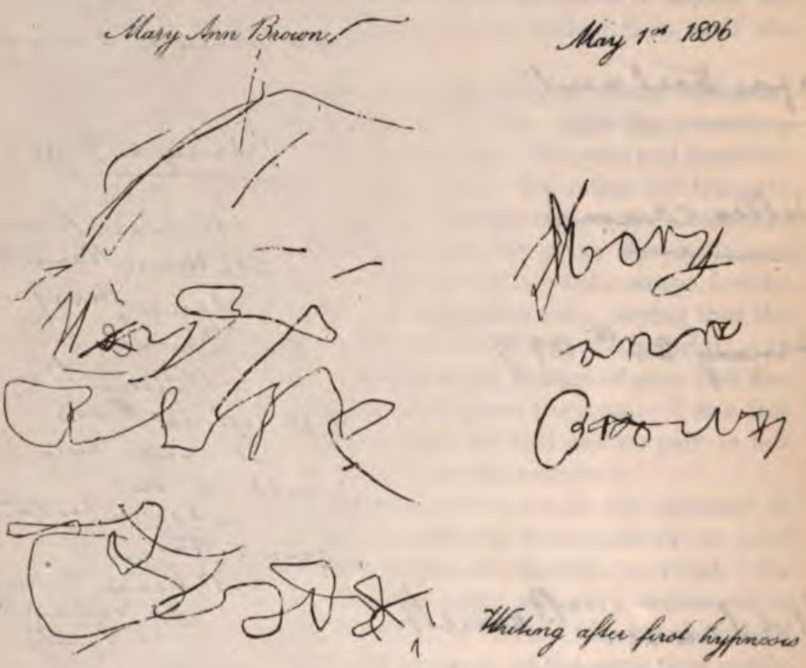
February 20th 1897

William Barnett
William Barnett
James Henry
Dearlin
William Barnett
of 51. Godwin Road
It would seem that
I could get on
I have no hesitation
in saying this
William Barnett
51 Godwin Rd
[illegible]

Case XI.—Mrs. M., wife of umbrella maker, aged 38, who was a resident patient in Hoxton House during 1892, suffered from *melancholia with delusions.* She fancied that men were following her to cut her up, after the manner of Jack the Ripper. She also had asthma and slept badly. I hypnotised her when she was in bed, telling her to sleep all night and to abandon the nonsensical idea that she was being followed, etc., and that she would awake, feeling happy and without asthma. My attention was called to this patient the next day by the nurse, who told me that Mrs. M. was helping her in the ward-kitchen. I then questioned Mrs. M., and was much surprised to find her apparently well. She said, "How silly I have been to have these fancies for over four months." The asthma had disappeared. I sent this case out on trial for a month, and as she remained well she was permanently discharged.

Before hypnosis.

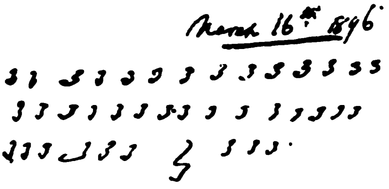
After hypnosis.

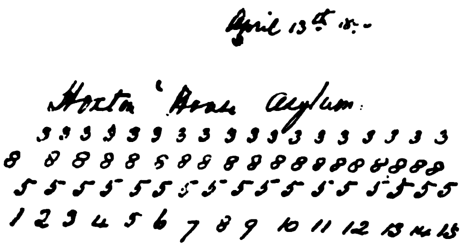

Mary Ann Brown
May 1st 1896
Mary Ann Brown
Writing after first hypnosis

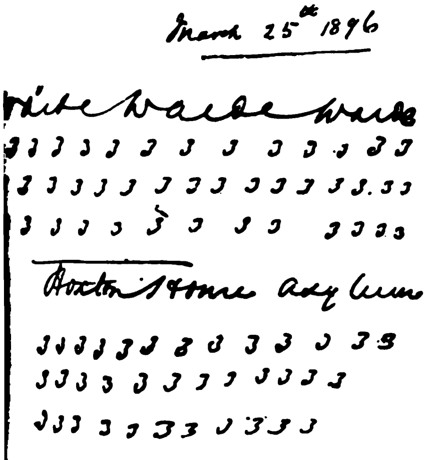
Case XII.—William Barnett, aged 34, suffering from *writer's cramp*, sent by Dr. Harry Campbell from the West End Hospital for Nervous Diseases, February 20th, 1897. Specimens of his handwriting before treatment and five minutes afterwards are shown on the previous page. I believe this patient has maintained the improvement.

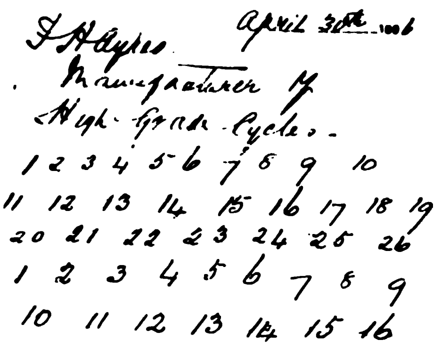
Case XIII.—M. A. B.—A case of *chorea* that had been under treatment for nine months before she came to me. Her writing before and after the first hypnosis is shown on the previous page. She was eleven years of age, and made a good recovery.

Case XIV.—H. I. W., aged 35, male, was troubled with *writer's cramp* from two to three years before I saw him on March 16th, 1896. He improved under treatment. I show four specimens of his writing at various dates in 1896. I saw this patient some time ago and the improvement was maintained.


March 16th 1896


April 13th 96
Hoxton Home Asylum
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15


March 25th 1896
Hoxton Home Asylum


April 30th 1896
Manufacturer of High Grade Cycles
1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19
20 21 22 23 24 25 26
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16

Stages of Hypnosis.—Many operators divide the state of hypnosis into various stages, according to its depth. Wingfield gives six, as follows:

Stage 1.—Those voluntary movements can be inhibited by direct suggestion which are most commonly carried out by reflex action in ordinary life.

Stage 2.—Contracture can be produced. Voluntary movement not included in Stage 1 can be inhibited.

Stage 3.—The subject can be prevented from stopping one movement voluntarily begun, and made to initiate another. Loss of memory for particular facts can be suggested.

Stage 4.—Loss of cutaneous sensation can be produced. Imperfect delusions can be suggested. Memory afterwards nearly or quite perfect.

Stage 5.—Senses more dulled. Visual and other illusions c be induced. Memory afterwards imperfect.

Stage 6.—Somnambulism. Anæsthesia, anosmia, etc., can suggested. The subject attends to hypnotiser only. No memo on awaking.

Charcot gives three : 1. Lethargic ; 2. Cataleptic ; 3. Somna bulistic.

Liébeault and Bernheim give six : 1. Torpor or drowsines heaviness of the eyes ; 2. Light sleep, when the subject is mo or less cataleptic ; 3. Deep sleep, in which the patient has n control of his movements ; 4. A very deep state. The subje hears the operator alone unless he is put into relations with oth persons ; 5. Light somnambulism ; 6. Is one in which the subje has no recollection of what he has done when hypnotised.

For therapeutic purposes stages are immaterial, and I nev trouble about them, as I find suggestions given in the light c waking stage are generally as effective as those given in the deep stages.

Conclusions.—Some members of our profession have still rooted aversion from treatment by hypnosis, and from their writin one would almost suppose that they would rather not cure at all tha resort to it. For this they assign various reasons, the most importan being that the operator can, if he chooses, acquire an undue an injurious influence over his patients. This grave indictment ha been so effectually disposed of by Dr. Milne Bramwell in hi excellent work, "Hypnotism : its History, Practice and Theory, 1903, that it is unnecessary for me to say anything further abou it. Even granting, however, that the medical man could obtai through hypnotic means, an unhealthy influence over his patient the fact could not legitimately be used as an argument against th therapeutic use of hypnosis. Should he so wish to influence hi patients there is surely no need to resort to hypnotism for th purpose ; but why should he desire it, any more than he shoul desire to injure them by the employment of other well-trie therapeutic means ? Assuming that he can make a poisonous us of hypnosis, can he not also make a similar use of drugs ? An no man worthy of the name of physician is likely to do the on any more than the other.

But while this absurd charge carries its refutation upon the ver face of it, the case is far otherwise in regard to the employment c hypnotic treatment by the unskilled layman. The danger here i not so much that the operator shall acquire an undesirabl influence, as that he shall, through a random and indiscriminat use of a subtle and potent agent, inflict serious injury. The public is constantly suffering at the hands of the so-called healer; this ever-credulous and gullible public is willing, nay, anxious, to regard the power to hypnotise as some mysterious spiritual gift, rather than as an attribute possessed by all, and explicable on known natural laws. They cannot look upon hypnotic treatment as they do treatment by drugs or electricity, or Röntgen-Rays, or any other recognised therapeutic agent to be prescribed by a physician only.

The so-called faith-healer knows nothing of the nature of the disease which he presumes to treat, nor of the difficulties which lie in his path; blind men have by faith been made to see, deaf men to hear, lame men to walk, then, why should not (so he argues) a cure be similarly effected of the case before him? The fact that there may be an insurmountable barrier in the way of cure, that the case may be essentially one for surgery, or for anti-syphilitic treatment, enters not into his mind. If it should chance to be one which lends itself readily to his methods, he will succeed, for a time at any rate, and if not, he recks nothing of the precious time and opportunity he may be wasting while the patient is being deluded with the false hope of recovery and passing beyond the pale of human help.

In spite, however, of the opposition which treatment by suggestion has met with, there are signs that it is growing daily less and less, and that this potent therapeutic method bids fair soon to be taught in our schools as a matter of routine. For myself, I am gratified and proud to say that I have received much help and encouragement from my professional brethren in pursuing this line of treatment, and my relations with them have ever been most cordial and pleasant.

List of Cases Treated by the Author.

	Number of Cases Treated.	Recovered.	Improved. Some still under Treatment and may Recover.	No Apparent Change.
Neurasthenia	1,016	928	57	31
Writer's cramp . . .	10	6	—	4
Chronic alcoholism . .	263	181	50	32
Stammering	18	11	5	2
Carried forward . .	1,307	1,126	112	69

	Number of Cases Treated.	Recovered.	Improved. Some still under Treatment and may Recover.	No Apparen Change.
Brought forward	1,307	1,126	112	69
Headache	239	209	17	13
Melancholia	136	103	16	17
Dyspepsia	70	65	2	3
Arthritis	61	16	27	18
Neuritis	80	66	10	4
Insomnia	120	98	16	6
Neuralgia	163	140	13	10
Lumbago	8	7	1	—
Torticollis (Spasmodica)	23	10	9	4
Sea-sickness	7	7	—	—
Sickness of pregnancy, etc.	6	6	—	—
Impotence	10	7	2	1
Sciatica	73	62	7	4
Asthma	9	5	2	2
Masturbation	15	13	1	1
Nocturnal incontinence	7	6	1	—
Gout	10	7	2	1
Urticaria	4	3	1	—
Blushing	2	1	1	—
Pain	5	4	1	—
Night terrors	7	6	1	—
Stage fright	47	40	7	—
Biting nails	4	4	—	—
Epilepsy	68	17	35	16
Functional paralysis	10	7	2	1
Hysteria	7	5	1	1
Menorrhagia	4	3	1	—
Morphia or drug habit	15	9	3	3
Tinnitus	8	2	3	3
Sprain	1	1	—	—
Spinal neuralgia	6	4	1	1
Chorea	56	46	7	3
Obsession	3	2	1	—
Locomotor ataxy	8	—	5	3
Spasm	6	2	4	—
Delusions	4	3	1	—
Bad temper	3	3	—	—
Pianist's cramp	3	3	—	—
Rheumatism	15	13	2	—
Tremors	4	2	2	—
Delirium tremens	1	1	—	—
Deafness	10	3	3	4
Palpitation and heart troubles	21	13	7	1
Loss of memory	2	1	1	—
Eczema	3	1	2	—
Hay fever	9	8	1	—
Paralysis agitans	9	—	3	3
Dysmenorrhœa	4	4	—	—
Carried forward	2,693	2,164	334	192

	Number of Cases Treated.	Recovered.	Improved. Some still under Treatment and may Recover.	No Apparent Change.
Brought forward	2,693	2,164	334	192
Phobias	32	28	3	1
Mania	46	22	16	8
Kleptomania	2	2	—	—
Chronic diarrhœa	1	1	—	—
Sexual perversion	2	2	—	—
Frequent micturition	1	1	—	—
Diabetes	2	—	2	—
Infantile paralysis	2	—	2	—
Opium habit	1	1	—	—
Loss of voice	2	1	1	—
Disseminated sclerosis	1	—	1	—
Refusal of food	3	2	1	—
Paralysis	7	1	3	3
Angio-neurotic œdema	1	—	1	—
Grand total	2,796	2,225	364	204

JOHN F. WOODS.

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IONIC MEDICATION.

By this term is meant the introduction of drugs into t
through the agency of an electric current.

The idea is an old one, but it is only within the last fe
that the principles which govern the process have been
formulated, and it is in consequence of the proper understa
the laws of electrolysis as applied to the human subject that
cedure of ionic medication has become of practical value.

Ionic medication is based on the principle that the cond
electricity in solution is necessarily accompanied by a t
of material, the electricity being conveyed by the move
charged particles (atoms or molecules) from one pole to th
The charges of electricity are given to the particles of liqui
poles of the circuit, and the positively charged particles are
from the positive pole and move towards the negative, w
negatively charged particles are repelled in like manner
negative pole and towards the positive.

These charged particles are called ions, or more dist
anions and kations. The anions are those ions which
negative charges and move with them from the negative
positive pole, and the kations are those which take up
charges and move from the positive pole to the negative.

In some liquids no ions are formed, and such liquids
conduct electricity. Examples of these in medical work are
ether, chloroform and the like.

Watery solutions of salts, including acids and alkalies,
ductors, and their ions can be introduced into the tissues acc
In the case of a simple solution of sulphate of soda the pa
a current leads to the movement of sulphuric ions tow
positive pole and of sodium ions to the negative pole. If an
ment is tried by passing a current through such a solution
some litmus has been added the action can easily be recogn
when a current passes the liquid is reddened around the
pole and is turned blue round the negative. The same
obtained if a pad formed of filter papers or of layers o
moistened with the solution and substituted for the v
liquid, or again the experiment may be performed by arran
electrodes upon different parts of the human body with

pads of moistened lint beneath each electrode. The change of colour of the litmus will in each case indicate the migration of the anions and the kations towards the metallic poles of the circuit.

The proof that the ions penetrate inwards from the moistened pads to the tissues may be given in various ways. Either the layers of the pads may be tested for the presence of the ions, and this is readily done in the case of many ions by reagents giving characteristic colour reactions, or the physiological test can be employed, as has been done in a very striking manner by Leduc. He took two rabbits and placed them in electrical conducting contact by shaving portions of the skin of each rabbit and fixing them together, with a layer of moistened tissue between, so that the current could pass readily from one animal to the other. An electrode with a pad moistened with strychnine sulphate was then placed upon each rabbit and the current sent through. After a short time the rabbit at the positive pole showed signs of strychnine poisoning from the entry of strychnine ions, but the rabbit at the negative pole showed no signs of such poisoning, as the ions entering it from the negative pole were not ions of strychnine but of harmless SO_4.

Two other rabbits were then taken and arranged as before, but the pads at the poles were moistened with potassium cyanide instead of with the strychnine salt. In this case it was the animal at the negative pole which suffered, the poisonous ion being the hydrocyanic ion, which is an anion and moves into the tissues from the negative pole.

The introduction of iodine ions into the body from a pad moistened with iodide of potassium can also be readily proved, as its presence in the saliva can be demonstrated with starch paper within a few minutes of the commencement of the experiment. Cocaine, too, can be introduced (from the positive pole) and an anæsthetic patch demonstrated in two or three minutes.

When it is proposed to introduce any substance into a part of the body by ionisation a solution is prepared and a pad consisting of several layers of cotton or linen is moistened with the solution, and this is laid upon the part to be treated. A suitable strength for the solution is one per cent. or five grains to the ounce. There should be a number of layers, to act as a reservoir of the solution from which the ions are to enter, and also by their thickness to absorb any undesirable ions formed at the point of contact of the metal electrode with the pad. Over the pad is placed a metal electrode of suitable size and shape, and this is connected to a battery or other source of continuous current; the circuit is completed by applying the other electrode, also well covered with moistened absorbent material, to some other convenient part. The choice of pole will be determined by the nature of the ion to be introduced. The ions of the metals, including the alkali metals, and of the alkaloids, enter from the positive pole, the ions of chlorine, of iodine, of the acids and of hydroxyl enter from the negative pole.

The ions of zinc, of copper and of some other metals, can be introduced by inserting into the tissue a needle of the metal, connected to the positive pole, and this procedure is useful in certain cases.

The magnitude of current to be used will depend upon the area of the pads, but a current of 2 or 3 milliamperes per square centimetre is about as much as can be borne without pain. The duration of the application must depend upon the depth to which it is wished to introduce the ion and the quantity set in movement will be measured by the magnitude of the current and the time of its passage, and further varies for each ion in accordance with the different electro-chemical equivalents of the different ions.

The electro-chemical equivalent of a body is the weight liberated by 1 ampère in one second. In the case of hydrogen it is ·01039 of a milligramme, and in the case of other substances it can be obtained by multiplying this figure by the figure representing the combining weight of the atom or molecule concerned. For instance, the combining weight of silver is nearly 108 times that of hydrogen, and in consequence a current which liberates 1 gramme of hydrogen will liberate 108 grammes of silver, and the electro-chemical equivalent of silver is obtained by multiplying that of hydrogen by 108, that is to say, 1·12 nearly.

Tables of the electro-chemical equivalents have been prepared for numerous elements and compounds or they may be calculated in the manner indicated.

Tables of the velocities of the ions are also given in text-books for many of the commoner ions. In general, it may be said that the ions of small mass, *i.e.*, of small combining weight, migrate more rapidly than those of large mass; the latter, therefore, penetrate less deeply in a given time, but on the other hand their greater mass results in their entering in greater proportional quantity.

The quantity of the ion which penetrates the tissues may be less than the quantity set in movement by the current.

The depth to which ions can be made to penetrate is an important consideration, when the treatment of conditions which are not superficial is contemplated. It is probable that the ions of the heavy metals combine with the phosphoric ions of the tissues to form insoluble phosphates, and so pass out of the ionic state in the form of a precipitate in the tissues, and are then unable to penetrate deeper.

In a general way, the ions which do not react to form insoluble compounds may be expected to penetrate to a depth ranging between 1 and 10 millimètres, or perhaps, in long applications of half an hour with strong currents, a little more.

Certain points must be borne in mind in connection with ionic medication as to the choice of the substances to be introduced. In the first place, only those substances can be used which undergo solution and are capable of conduction when dissolved. Most organic bodies which can combine with either an acid or an alkali to form a soluble salt may be so used, and the alkaloids, adrenaline, aniline and many of its derivatives, salicylic acid, and many other useful drugs, will occur to one's mind in this connection. Carbolic acid cannot be used; it is wrongly named, and is an alcohol and not an acid compound.

There are certain chemical bodies, such as chlorine, iodine, caustic alkalies, strong acids, which in their usual form have a powerful effect upon protoplasm but are not suited for ionic medication, for their action is rather an action due to their concentration than to their intrinsic properties. Chlorine, for instance, in the form of chlorine water, is a powerful oxidising agent, but chlorine ions, which exist in abundance in a dilute solution of sodium chloride, have not that property, and the introduction of chlorine ions or of iodine ions would result in an effect resembling that of the chlorides or of the iodides, and not at all like that produced by applications of free chlorine or iodine.

Different ions vary very much in the amount of their action upon the cutaneous sensory nerves; and in all cases the ionisation is apt to be somewhat painful during their entry, except when very small currents are used, but the degree of pain felt is much greater at the commencement of an application than is the case a little later. It is an important practical point to increase the current very gradually at the beginning; and two or three minutes may well be expended in bringing the current up to its desired magnitude.

Ionic medication is specially suited for the treatment of superficial conditions because the depth to which ions can be introduced is limited. At a certain distance from the point of entry, a distance of a few millimètres, or at most of a centimètre or two, the ions introduced become merged in the general crowd of ions of the juices of the body, and after that the transporting power of the current no longer bears upon them appreciably.

At the present time the useful applications of ionisation are but few, as each fresh fact in the employment of ions in treatment has to be established by practical clinical work, but it is probable that among the numerous ions whose properties are as yet either unknown or only slightly known, some will be discovered to provide new and valuable applications of the ionic method. Hitherto work has been done upon only a few ions. Zinc and copper have been used for their antiseptic properties, to promote the healing of obstinate ulceration and in superficial bacterial infections. The successful use of zinc in ulcers of the rectum, of the leg, and of the cornea, have been recorded. Iodides and salicylic acid have yielded good results in some forms of arthritis of accessible joints, in sciatica, and in trigeminal and other neuralgias.

Chlorine and iodine ions are valuable for the softening of cicatricial tissue and thus for removing adhesions around joints. Many writers have recorded cases in which quinine and salicylic acid have relieved neuralgias, but much ionic work to-day is still in the experimental stage.

The following details will be of service.

Rodent Ulcer.—Ionisation with zinc has been used successfully in many cases and frequently brings about a permanent cure after one, two or three applications. It is most useful in small early cases. The current to be used should be about 10 milliampères from a positive pole of zinc covered with a pad of lint cut to fit the ulcer and soaked in a 1 per cent. solution of a zinc salt, such as the sulphate or chloride.

Boils and Carbuncles.—Leduc states that these can be arrested in the early stages by ionisation, using a zinc needle as the ionising electrode. This is thrust into the tissue in several directions, so as to ensure the passage of the zinc ions into the depths of the swelling. The pustules of sycosis can be treated in the same way.

Warts can be removed by ionisation with a zinc needle. For small warts a current of 1 milliampère for one minute is enough.

The treatment of **Lupus erythematosus** and **lupus vulgaris** by ionic medication has not yet given results which are uniformly successful. More work is needed and new ions must be tried for these conditions before adequate success can be claimed.

Trigeminal Neuralgia.—Many successful cases have been recorded by several writers. Usually salicylic ions have been used and less frequently quinine. Large electrodes are to be used to cover the affected area, and large currents of 30 milliampères or more for twenty or thirty minutes, the drug to be in 2 per cent. solution.

The solution should be used on large pads of twelve or sixteen layers. A flexible silver or zinc electrode is applied over the pad and fixed so as to avoid any interruption of the current during the application. The negative pole is used for salicylic ions and the positive for quinine. The method is not very favourable in neuralgia following herpes zoster of the trigeminal nerve.

Chronic Synovitis.—Ionisation with iodides or salicylates is useful in some forms of chronic joint affections. The method is most applicable to joints which are not too thickly covered by soft tissues. Large currents and long sittings are needed as for neuralgia.

These strong applications can be applied twice a week. More than that is likely to injure the skin and to delay the treatment.

H. LEWIS JONES.

TREATMENT BY VARIOUS FORMS OF LIGHT.

WHO does not know the exhilarating effects of the morning s
From the very earliest times there have been those who w
conscious of the beneficial properties of light. For certain i
that were the rays of the sun cut off from us for a single mo
the earth would die and life upon its surface cease. Such cr
methods as the passing of the sun's rays through water contai
in various coloured bottles, the liquid thus treated being admi
tered in two or three tablespoonful doses, have in days gone
found advocates, and the wearing of certain coloured materi
living in rooms whose paper and hangings reflect certain tones,
know to influence not only the feeble-minded but the strong.
hangings around those suffering from smallpox have at times b
much in vogue. The son of Edward I. was treated for small
with red methods by one John Gaddesden, who took no s
credit to himself for bringing his royal patient through his se
illness with success. Undoubtedly blinds that filter the sun's r
and prevent certain properties from passing, the ultra-violet r
have a beneficial effect upon the healing of the spots. M
simple instances of the effect of light and colour upon the sys
could be brought to mind, and not alone upon animal tissues,
experiments on vegetable life show the marvellous difference in
development that takes place under the differing properties of var
coloured light. But now that we understand the solar spect
better, the treatment by various forms of light energy becom
definite and complete study and able to hold a place among
recognised therapeutic methods of the day. We would willi
use the sun's rays to produce these therapeutic effects, but
obstruction to their passage, owing to the mists surrounding
earth's surface, particularly in the British Isles, and the var
climatic changes, make this impracticable. In some part
Germany and Austria during the summer months patients
expose themselves to sunlight. The beneficent action of l
energy was appreciated by the ancient Greeks and Romans, evid
of their luxurious *solaria* being still in existence to show the les
they learnt from their practical experience.

Incandescent and Arc Light.—As a substitute for the s
rays we now use in general two forms of light, that given off f

incandescent electric lamps and that proceeding from the electric arc, formed between two points of carbon or iron, and called the arc light. Each has its therapeutic value, but that of the former is limited by the glass surrounding the incandescent filament, for the chemical or ultra-violet rays can only pass sparingly through glass, whereas the arc light, being generally used as a naked light, allows all its energy to be concentrated, and in this way we get the full value of its therapeutic effects.

Blue and Red Light.—Though a ray of light is of much therapeutic value in its entirety, yet our knowledge of the solar spectrum now enables us to pick and choose among the various parts of it, and make use of their differing qualities in the treatment of various forms of disease. The blue and red rays of the spectrum are those chiefly employed, for the first with their shorter undulations and chemical properties will pass through blue tinted glass, which excludes the longer, hotter and less chemical red rays. The red glass, in its turn, will prevent the passage of the shorter actinic blue rays.

Exposure of the Body to Light.—This may be obtained in two ways. The one, a general exposure, in which the whole nude body is bared to a rich glow of light, reflected upon all parts of it as in the cabinet light bath (*see* Figs. 1 and 2). It is not intended here to explain the methods of the open-air sun bath as still used in some parts of the Continent, for this mode of treatment is becoming rare, and the therapeutic effects aimed at are similar to those which can be more successfully gained in the cabinet baths, which are now in common use at all establishments where the value of the treatment is recognised. The second method of exposure is where a strong concentrated beam of light is focussed upon any given part of the body, and obtained by various forms of apparatus which are described later on in detail.

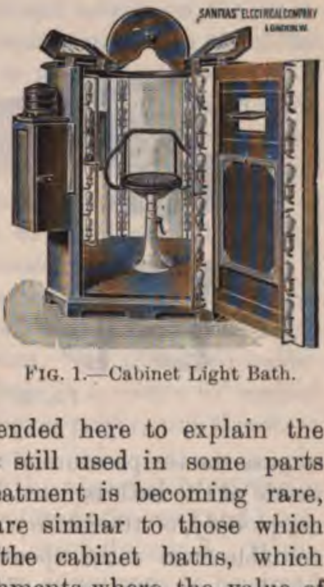

FIG. 1.—Cabinet Light Bath.

TREATMENT BY GENERAL EXPOSURE.

The Light Bath.—This consists of a wooden cabinet of sufficient size comfortably to surround a person sitting upright in a chair or reclining in a more extended position, and having an average space between him and the walls of the cabinet of about 18 inches.

The walls are lined with some brilliant white porcelain or painted material, or even looking-glass, so that the rays from the many lamps are reflected on all parts of the body. In the upright bath the patient, sitting in the centre, has only his head protruding from the top of the cabinet, which is closed in around him to the level of the neck, where a towel fills in any aperture there may be. The chair is capable of being raised or lowered to suit the patient's length of back, and should revolve so that any particular part of him can be more fully brought under a concentrated light which may be focussed upon him by means of a projector (described later) applied from without through the door of the bath. This door is made up of small sections, so that when one is opened for the rays to pass the temperature of the bath is not materially lowered. The inside of the bath is fitted in some cases with rows of incandescent lamps only, of 16-candle power. A better form, and by far the most valuable from a therapeutic point of view, is the combined bath, which has in addition an electric arc light at each angle, making four in all, which reflect their powerful rays without any obstruction full upon the body of the person within. Under the seat are more incandescent lights, and the foot-rest with a glass top is also illuminated with three or more lights. This must not be confounded with baths such as the Dowsing, in which, although a certain amount of light is present, the incandescent lamps are enclosed in long glass bulbs made of ground glass and thus emitting no light of therapeutic value. These latter baths are of use only for the radiant heat they produce, and their sudorific action is their chief factor.

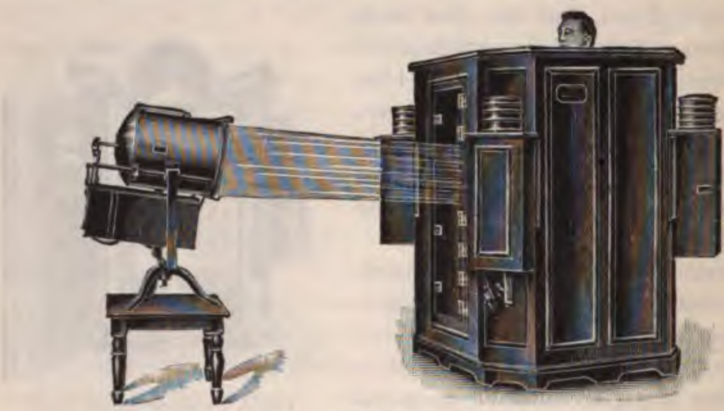

FIG. 2.—Light bath and projector.

We must now consider the quality of the light exhibited in the bath and its therapeutic value, and first **the incandescent lights**, which in a good cabinet bath number from fifty to eighty, and are usually 16-candle power. These should be controlled by a rheostat, so that the intensity of their glow can be regulated from a weak light to an intense brilliant incandescence, and thus the dosage graduated. All light confined within glass loses some of its therapeutic value, as the ultra-violet rays pass only sparingly through glass. The blue, indigo and violet frequencies, however, do pass through, and consequently the light emitted by so many lamps, confined in a small space, has a distinct chemical value, and more than a sudatory effect, whilst the heat also is of a different quality from that which proceeds from hot air or steam.

The *therapeutic effect* then produced by a light bath fitted with incandescent lights only, is: (1) A profound action on the vaso-dilators of the arteries. By the stimulation imparted to them the blood is permitted to flow more rapidly to the surface, the heart is relieved of its burden, the constriction of the arterial circulation and the capillaries is also lessened, and there results lowered tension of the blood stream, with an increase in its volume and uniformity. From this follows a marked effect upon the sensory centres, which is shown by a diminution of irritation and debility. (2) By the dilatation of the cutaneous vessels a revulsive effect is produced, and passive venous congestions are connected with active arterial hyperæmia. (3) The sweat glands also are profusely acted upon with corresponding active elimination. (4) Increased oxidation. The general result from these effects is a return to normal skin activity, normal circulation and oxidising power, and therefore increased tone.

Certain *precautions* must of necessity be observed in giving a light bath. A cold bandage should be applied to the neck and head, and the condition of the quickened pulse carefully noted. If the patient is robust and a distinct and sudden stimulus is to be aimed at, the full power of the lights may be at once switched on, but otherwise the lights should be gradually applied and plenty of air allowed to play about the face of the patient, and even through the bath itself. The temperature within the bath must be carefully watched, and for this purpose a thermometer is so arranged in the top of the cabinet that the mercurial bulb is within the bath and the index without, where it can be easily read. Unless otherwise indicated the temperature should be from 100° to 110° F., and in no case, unless a profound sudatory effect is desired, is it well to go above 140°. The aim should be to keep the temperature down rather than to allow it to mount up. Where long exposures of thirty to forty minutes are given with the arc light working only it is imperative during the whole treatment to maintain an even and low temperature and to allow plenty of ventilation through the bath. The valuable asset is light energy, not a sudatory effect. With regard to the *duration of the treatment*, if the effect desired is stimulation, a short time (five to ten minutes) is best, but if a profound arterial or sudatory effect is aimed at, as for diabetes or diseased kidneys, a prolonged exposure of fifteen to thirty minutes is useful. In all cases the light bath should be followed by a water bath, a douche, or a wet pack. Each case will present its own indications, but for stimulation the temperature of water at 65° or 70° F., or a sharp douche of even 50° is well borne, but after a longer exposure to the light a higher temperature at first and a more gradual application of the cold is best. The aim should be to assist the return of circulation to healthy conditions, care being taken not to overtax the strength of the patient after the bath. In all cases it is imperative to allow the skin to become dry and cool by reclining for a time in the towels, and feeble patients should rest upon a couch for an hour or more. During this interval a feeling of well-being is experienced. As to the *number of baths* that may be taken, if the exposure is short, a bath each day for four or five days is not excessive, but the intervals between them should then be extended. If the exposure has been long, three baths in a week and later on two will be found as many as it is wise to prescribe. The chronicity of the disease will determine how long a course of treatment should be enjoined.

We now come to our second source of light, **the arc lights.** In a bath such as I have been describing these are four in number, one at each angle of the cabinet. When an electric current is passed down two rounded portions of carbon, one representing the positive pole, the other the negative, an electric arc or continuous spark is formed where the two approximate. This arc gives off the rays we are anxious to reflect. After the carbons have been in use a few minutes, a depression called the crater is formed on the positive carbon; from this centre and from the conical shaped end of the negative carbon an immense heat is thrown out. From the intermediate continuous spark, which is of the nature of vapour and of a bluish white colour, come the ultra-violet rays, and also the blue and green. We have from this combination the nearest approach to sunlight of any kind of light we possess. It is even more valuable from a therapeutic point of view, for the chemical or ultra-violet rays of the sun's spectrum can only sparingly struggle to the earth, especially in the British Isles, on account of the mists that envelop its surface. Where the patient's body is brought within the vicinity of the electric arc, all the useful rays can be focussed upon its surface, with the result that we possess a potent light of from 500 to 1,000-candle power. The candle power of an electric arc depends upon its volt-ampères. Therefore, if we are operating with four arc lights in series in a light bath, with a current of 15 ampères, the nude body of the patient, with the light reflected upon it from the lamp's own reflectors as well as the white enamelled walls of the cabinet, is bathed in a sea of light of over 3,000-candle power. It must not be forgotten that the value of the arc light depends largely upon its power to produce ultra-violet rays. Its sudorific effects are small as compared with those produced by the incandescent lights with which the bath is also furnished. The first effect of the ultra-violet rays is a superficial bronzing of the skin from the development of pigment, nature's defence against any detrimental effect of too bright a light upon the deeper layers of the skin. One or two baths in arc light are quite sufficient to produce this, which is looked upon erroneously as a healthy condition of the skin. The same effect is produced in the clear and rarefied air of the snow and ice regions. The ultra-violet rays will also penetrate the superficial layers of the skin, particularly in parts that are bloodless, and if this action is carried too far inflammatory erythema is produced.

We come now to the action of these rays upon the blood, which makes the light bath such a valuable help in cases of anæmia. M. Manté has carefully studied the cellular composition of the blood in cases treated by radiotherapy, and has noticed that during the hour following the exposure there is an appreciable modification of the cellular equilibrium of the blood, which is attended by an increase of both the white and coloured corpuscles, the percentage of polynuclear and large and small mononuclear cells being greater than normal. Of great value also is the action of light upon metabolism.

Margaret Cleaver says in her wonderful contribution on "Light Energy": "In our study of the action of light upon animal organisms it was found that after an initial decline there was an increase in the weight of the animals exposed to light as against those kept in darkness, and that also tissue change went on more rapidly under the influence of light. This action may be explained by a stimulation of the nervous system, which in its reaction stimulates other vital functions, or it may be a direct action upon the blood stream itself. Of the fact that certain modifications in the tissue—change in both men and animals takes place under the influence of light energy there is no question. This action must be twofold, *i.e.*, upon the blood directly, and indirectly through the nervous system." Another useful property of ultra-violet light is its bactericidal effect. Marshall Ward[1] and Strebel[2] have both furnished proof of its powerful bactericidal effect, the latter by his experiments showing that all kinds of microbes brought within a distance of 70 to 140 c.m. of a spark light containing ultra-violet rays are killed in a few minutes. The value of this effect in the treatment of skin diseases becomes at once apparent. The action of arc lights is also disinfectant and deodorant. Experiments were made some years ago with Jablochkoff candles in the Paris sewers for the purpose of purifying them; the results were reported to be very satisfactory. We may sum up, then, the therapeutic effects of treatment by a combined incandescent and electric arc light bath: (1) Dilatation of the blood-vessels, with consequent lowering of arterial tension, relief of heart strain, reduction of venous congestions, and general stimulation of all excretory organs of the body; (2) action upon sweat glands, and active elimination from the pores of the skin; (3) increased oxidisation of blood, with a general improvement of its cellular composition; (4) marked effect upon the sensory centres, causing a reduction of pain and nervous irritability; (5) bactericidal effects, and consequent valuable healing properties in skin lesions.

In the space at my disposal it will be impossible to give detailed accounts of cases treated by light baths, but it must be obvious to any unbiassed scientific mind that where therapeutic effects such as I have enumerated can be so easily and comfortably attained, an immense power for good is within the reach of any who can effectually use them. It is not out of place to say that there is no "rule of thumb" in these methods, and that there has been a tendency in the profession to allow this treatment to fall into the hands of those who have not the medical training or knowledge to appreciate its significance and value, and have therefore lost much of the benefit that might have accrued from its careful use. Treatment by Light Baths is a most valuable adjunct to that for local lesions. Thus: (1) In a case of chronic eczema better results are obtained if before an X-ray exposure, or an application of the effleuve of the high frequency, a bath is given; there is then an increased elimination from the skin, with the consequent removal of crusts and bacteria from the surface, and valuable oxidisation of the blood; (2) a case of painful gouty swelling before being subjected to ionic treatment or vibratory stimulation will derive much benefit from the bath, by its power to eliminate uric acid from the system, and by the relief of pain and tension that the light can produce; (3) in chronic bronchitis before the patient is subjected to mechanical vibration or general chest development much benefit is derived from a light bath owing to its influence upon the circulation, which relieves the overtaxed heart, and the restoration of the balance of secretion in the mucous membrane; (4) in cases of diabetes, the effect of high frequency treatment is enhanced by the use of the bath owing to its sudorific effect and its stimulation of the circulation.

A well-equipped light bath should possess a like number of **blue and red incandescent lamps**, that may be substituted for the white lights in ordinary use, and also blue and red glass shades to place before the arc lamps, in order that the bath may be converted into a blue or red one, as there are some indications that call for a strong use of one or other of these colours, more particularly in the treatment of diseases of the nervous system and skin. Some authorities have operated with a combination of the two colours, but the writer has not found this combination to be of much value, and has preferred to use the strong influence of each colour by itself. The *blue light bath* is called for in highly excited conditions of nervous exaltation, bordering upon acute mania, for it has an undoubted effect upon excitability of the cerebral cortex. Care must be taken not to overdo its sedative effect, for a depressed condition quickly follows, when it will be wise to continue with the white incandescent lights and the arc lamps shaded blue, until the full refreshing light of both incandescent and arc lights in their natural strength and colour is able to be borne. Blue light is also very soothing to painful neuralgic conditions and a state of hyperæsthesia, and the writer has found a large admixture of blue light very comforting in painful muscular rheumatism, in extensive bruising or strain from injuries, and in the stiffness that results from prolonged exertion of muscular tissue out of condition. A most successful result can be obtained by the blue bath upon the continuous fidgety cough that so often follows influenza; in fact all irritable conditions, nervous or otherwise, of the mucous membrane will derive benefit from its influence. Its action upon the healing of wounds will be touched upon later. In marked contrast to this sedative effect is the influence of a *red light bath*, which is highly exhilarating. For a depressed condition of the nervous system and many phases of neurasthenia it has no equal. A red light bath followed by an electrical treatment will remove immense loads from the mind of the neurasthenic, increasing the appetite and regulating the digestion and nutrition.

Pansini, of Naples, has given much time to the elucidation of his theories as to the influence of red and blue light. He speaks of the cerebral excitation produced by the influence of red light on those obliged to carry on their avocations in a room with red glass in the windows, their condition becoming so extreme that it was necessary to replace it with glass of a green colour. Olenikoff noticed the same condition in smallpox patients in the clinic of Tschistovitsch who were submitted to the red light treatment. They suffered from delirium with frightful hallucinations, which at once passed off when they were removed into natural light. The fury produced in the bull by objects of red colouring is due to a similar cause. These facts lead to the conclusion that the influence of red light is of a dynamic character and an excitant to the nervous system in general, but especially to the psychic functions. The following is a list of diseases in which the light bath is of service:

(*a*) All conditions depending upon a gouty or rheumatic diathesis.
(*b*) All conditions of anæmia and chlorosis.
(*c*) All conditions dependent upon sluggish or impaired circulation.
(*d*) Nephritis and diabetes.
(*e*) Neurasthenia and nervous disorders.
(*f*) Skin lesions and syphilitic conditions.

TREATMENT BY LOCAL LIGHT BATHS.

It is necessary to say a few words upon *local light baths* (see Figs. 3 and 4). Much that has been said upon the effects produced by the cabinet bath, equipped with incandescent lights, is applicable here, for the local bath contains incandescent lights of 16-candle power, and it should be possible to use in them red and blue lights in addition to the ordinary white lamps. As their name implies, they are for the treatment of a part of the body only, and are made of various sizes, the largest being that which will span the trunk of the patient. They are more commonly used for the treatment of the extremities. They are represented by a half-hoop, with lights placed in the concavity, two, four, or twelve, as many as can be accommodated in the size that is required to fit over the part to be treated, knee, ankle, shoulders, etc. All that has been said as to the value of incandescent lights should be borne in mind, and how the chemical rays can only pass sparingly through the glass surrounding the filament. The fact should also be noted that by increasing the current it is possible to increase not only the luminous but the chemical efficiency of the light, so that by the use of 32 or even 50 candle power lamps the blue-violet rays that are given off will amount to a chemical action of considerable value. The chief use of local light baths is for the treatment of joints. A higher temperature can be borne without discomfort in a local bath than in the general light bath, a temperature of 210 to 220° F. in some cases only giving a feeling of comfortable warmth. In this way an intense hyperæmia is produced, with a corresponding stimulation to the circulation of the part. The writer has found this hyperæmia a very valuable preliminary method to the use of ionic medication, and in his opinion one of the most serviceable uses of light is that of preparing the tissues for treatment of another kind. The local bath with white or blue lamps has a very beneficial effect upon rheumatic or gouty swellings, and tuberculous joints also are effectually treated in this way.

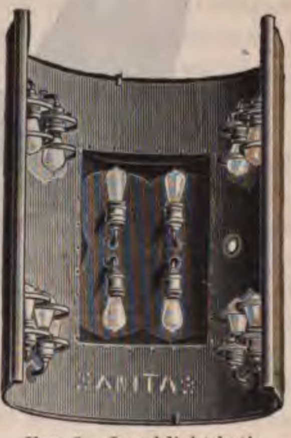

FIG. 3.—Local light bath.

The indications for incandescent light energy applied in this way are not only with reference to joints, but injuries, sprains, contusions, superficial inflammation and suppurations. The after-treatment is important. When free perspiration has been established the part should be well rubbed down, and massage or active or passive resistance movements, if indicated, begun without any interval, for it is well that a reaction should at once be set up before the part has been allowed to cool down. In some cases cold may be applied with friction, or the cold douche carefully and gradually brought to play upon the part. A case under the writer's treatment will illustrate the value of the local light bath. A young man placed under his care by a lady doctor of Lisbon, practising with light and electrical methods, had been upon his back for some fourteen months, the result of falling from his bicycle on a tram-line, and the verdict of his doctors was that his knee-joint was tuberculous and amputation must be performed. The right leg was absolutely fixed in a straight position, any movement in the knee-joint being entirely absent. The joint was somewhat swollen and tender, and the constitution much enfeebled by pain and confinement. Recourse was at once had to the local light bath with blue lamps of 16-candle power for half an hour at a time, twice a day. After each exposure gentle massage with slight passive movement was adopted. In a few days the tissues round the jo began to lose their tense, immovable condition, and the gene repair of the joint with the wasted muscles of the limb by electr and vibration methods adopted, so that in three months he able again to fulfil the obligations of his business, which w those of a commercial traveller.

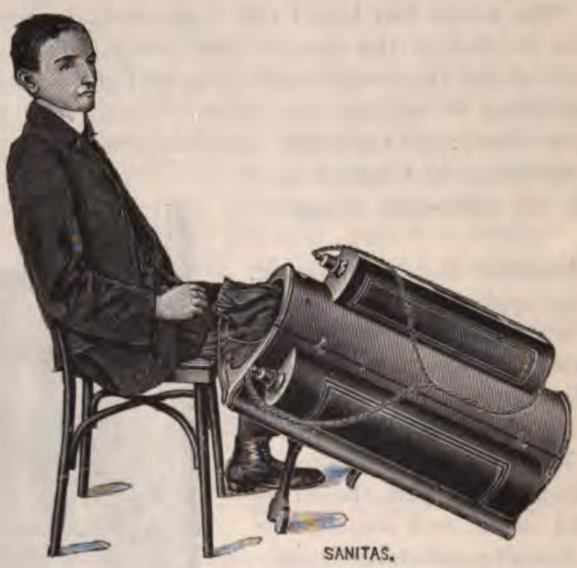

FIG. 4.—Local light bath.

TREATMENT BY CONCENTRATED LIGHT ENERGY.

It is not within the writer's province to examine in detail report upon, the treatment by certain special rays of light, as the X-rays. Nor will he trespass, other than in a general upon the ground of the dermatologist, where, since the resear of Finsen, Becquerel and others, the use of special forms of energy have become so important.

The treatment by concentrated light divides itself into two he according as one operates with the incandescent electric ligh the arc light.

Concentrated Incandescent Light.—This may be further divided by the use of white, blue or red light. It will be rememb that the value of an incandescent lamp varies with its ca power, and the high candle powers give off valuable green, blue violet rays, which, although they have a beneficial chemical a upon the tissues, are not to be compared in utility with the ultra-violet rays given off by the arc light. The action, therefore, of incandescent light is somewhat restricted. If strong lamps are used in the local light bath a concentrated incandescent light treatment can be given, but there is a mechanism which is now becoming very popular, especially in the United States, in which an incandescent lamp of enormous candle power (500 or even 1,000) is set within a dome-shaped reflector, and suspended from an arm which can be raised or lowered and so inclined that it can be conveniently brought to play upon any part of the body requiring treatment. Such a lamp will throw off immense heat as well as valuable chemical rays, and is used to produce a powerful hyperæmia as well as a direct stimulus and a resolvent effect upon rheumatic joints or neuralgic conditions. Such an effect is produced by passing the light slowly, as it can be tolerated by the patient, up and down a painful nerve or a brachial neuritis, to be followed or not by treatment with electricity or mechanical vibration.

Blue Incandescent Light can be used with advantage in a similar mechanism upon many and varied diseased conditions. Dr. Minim, of St. Petersburg maintains that, acting strongly on the vaso-motor centres, it is endowed with analgesic qualities, and therefore can ameliorate or cure superficial neuralgias. He found the anæsthesia produced by it to be as marked as that produced by cocaine, and employed its pain-alleviating powers by focussing it upon painful pleurisies prior to physical examination, subsequently using it instead of cocaine where incisions and stitching of wounds were required or in the opening of abscesses. He also established the important fact that the effect of blue electric light was the reverse of white light, that a granulating surface became anæmic under the influence of blue light and hyperæmic under white light. Azienzo and numerous other authorities have testified to the value of blue incandescent light in the treatment of neuralgic conditions and to its soothing properties, and this coincides with the writer's everyday experience. Another beneficial effect of blue light must be mentioned, that upon the mucous membrane. Acute catarrhal inflammation of the throat, as well as more chronic ones, will yield to these methods. The rays must be focussed to shine down into the throat at a distance that can be comfortably tolerated and upon its outer surface. Dr. Pietnikoff reports five cases treated in this way, with the following results:—(1) The course of the disease was considerably shortened; (2) after the first sitting the action of deglutition became much less painful; (3) the exudate disappeared after the first or at the second sitting; (4) the diffuse redness of the mucous membrane disappeared speedily after the second treatment; (5) the swelling of the tonsils diminished markedly after the first sitting, and the fever subsided

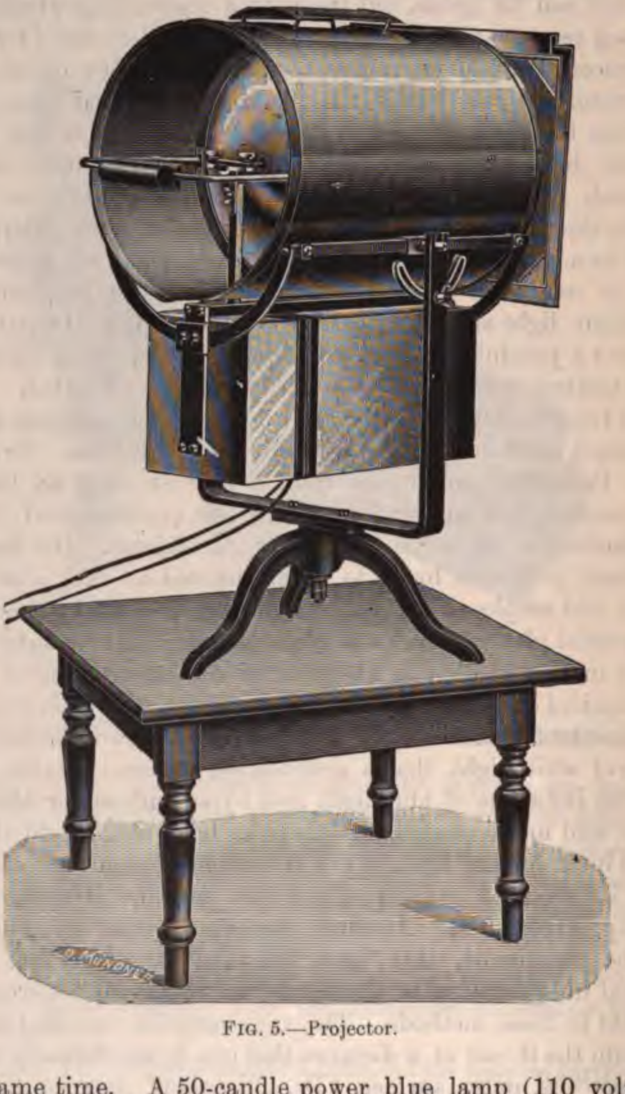

FIG. 5.—Projector.

at the same time. A 50-candle power blue lamp (110 volts) was used, and the applications lasted from ten to fifteen minutes each.

With regard to **Red Incandescent Light**, mention has already been made of the beneficial effect of an exhibition of red light and hangings, clothes, etc., in the treatment of smallpox.

But the effect gained seems to be something more than upon the healing of the spots. Other acute febrile diseases have been treated in this way in the clinics abroad, with varying success. Reports of cases of measles, scarlet fever and erysipelas are to hand, in which the treatment was distinctly successful. For measles and scarlet fever it is claimed that the hyperæmia was lessened, the laryngeal and bronchial symptoms improved, the desquamation diminished or prevented altogether, and the course of the illness modified in duration and severity. It will be remembered that the red light prevents the passage of the chemical rays, and in this way differs from the influence of blue light, and upon this fact depends the success gained in the treatment of acute febrile diseases, especially erysipelas. Dr. Kenkenberg, of Munich, who has given much attention to this subject, maintains that the chemical rays are particularly harmful in these diseases, and advances the theory that the negro, by reason of the pigmentation of his skin and consequent protection from the action of these frequencies, is much less susceptible to erysipelatous and phlegmonous inflammations. Reporting on eighteen cases of erysipelas treated with red light, he states that the fall in temperature and the general amelioration of the symptoms were unquestionably due to the exclusion of the chemical rays.

We now have to consider **Concentrated Arc Light** and its manner of application. Various lamps have been invented for the purpose but they naturally divide themselves into two classes, those used for skin diseases, such as a Finsen lamp, and designed for close application, and those made to reflect the rays on to larger areas and at a greater distance from the patient. With this general distinction we must be content only to describe in detail the latter, and for further information respecting the former the reader is referred to articles which deal with such diseases as lupus, rodent ulcer, etc. The mechanism most commonly used for the general application of concentrated arc light is identical with the marine searchlight, and called a "projector." This is a drum-like structure of block tin (*see* Fig. 5), open at each end. Within it the carbons to form the arc light occupy a position in its centre, running in the same horizontal line as the drum-like exterior; close behind the carbons a concave reflector, which completely fills the drum, is capable of being moved forwards or backwards, and in this way alters the focus of the light. At the other end of the drum the opening can be closed by a frame of red or blue glass, or a funnel-shaped attachment to further collect up the rays. The usual mechanism found with arc lights to keep the carbons in apposition is beneath, the whole is mounted on a frame that allows it to swing round or the ends to lift up, that the focus may be brought to bear on the part of the patient to be treated. The strength of the arc to be effective should be 20 to 80 ampères. The value of this light, with its ultra-violet frequencies, is indispensable to good work, and many of the effects just described in speaking of concentrated incandescent light, except those in which these rays are distinctly detrimental, as in the treatment of erysipelas, small-pox, etc., can be more easily produced.

Passing over the many uses of the concentrated arc light in the treatment of skin lesions (*see* articles on Diseases of the Skin), we come to its power of healing wounds, and here the bactericidal effect of its ultra-violet rays is a great asset. An illustration of its power to heal will best be served by detailing the circumstances of cases that came under the writer's treatment. A feeble middle-aged woman, with symptoms of gouty dyspepsia and much debility, complained of the condition of her feet, owing to which she could only walk with difficulty. They were scored across and across with cracks 2 to 3 inches long, and quite ¼ inch deep in the worst places, where streaks of blood were showing. An electric foot bath every other day followed by an exposure of concentrated blue arc light for half an hour, in a month gave her a completely new and smooth skin upon her feet, without a sign of the old gouty cracks. In a second case a woman, with a beautiful complexion, complained of being run down and of having much pain in her back. This was due to a most disgusting form of acne indurans. Several large discharging boils were scattered amongst the crop of acne spots extending over her shoulders and back. She had persevered in many treatments to get rid of this state of things, but being a delicate woman, could never get well enough to throw it off. By raising her system to a better level with light baths and high frequency, and treating the back with exposures of concentrated blue arc light for half an hour afterwards, a healed skin and a return to good health was procured. Tuberculous ulcers show satisfactory healing power under concentrated arc light. Dr. Ravogli reports cases that yielded to his treatment in a few weeks by fifteen minutes' exposure twice a week. "The treatment stopped the itching and burning sensation, the entire surface became red and erythematous, the ulcers appeared as if painted with gelatine, the yellowish necrotic appearance disappeared, and in a short time they healed up, the small tubercles disappeared, a healthy cicatrix formed, extending from the edges towards the centre, the patient making a complete recovery."

The treatment by this means of tuberculous glands must not be passed over. It is distinctly successful, especially if combined with gentle mechanical vibration. Margaret Cleaves uses a 25-ampère concentrated arc light, giving sittings of thirty to forty-five minutes duration, three times a week. All tenderness disappears, cicatrices heal, the scars of old incisions and ruptures improve in appearance, and the glands diminish in size or entirely disappear.

Light Treatment in Tuberculosis. — Some good work has been done in this direction by Margaret Cleaves in New York, Courmelles at the Saint Louis Hospital, and others. Different methods of applying the light have been resorted to, some passing the rays through blue glass and thus cutting off the red, hotter frequencies, but all have used the concentrated arc light focussed upon the nude chest, for long exposures, with the result that within a few days in most cases there has followed a diminution of cough, temperature, expectoration and night sweats. The treatment of tuberculous joints has already been touched upon, and here I would quote Tsiechanski, who has reported many cases of tuberculous joint conditions successfully treated with the electric arc. He uses arcs of from 80 to 100 ampères at 35 to 40 volts, giving a light of 12,000-candle power. From his experience he concluded that the treatment gives favourable results, is absolutely painless, and replaces altogether all other methods of treatment. Chronic synovitis and inflammations involving the articulating surfaces of joints will often yield to the treatment of concentrated arc light, when other methods have failed. The best success obtained by the writer has been with a combination of the arc light and constant electric current. The softening influence and hyperæmia produced by the exposure to light, followed by the absorbing properties of the constant current immediately following it, produces very salutary effects. The best method to adopt is half an hour of each treatment taken at the same sitting, every other day.

Light Treatment in Gynæcology has been used as supplementary to X-ray treatment of extensive epitheliomas, not so much as a curative agent as a palliative one. By its use the pain of inoperable pelvic growths involving the vaginal walls and cervix uteri has been relieved, as well as the hæmorrhage and ill-smelling discharge. Experience teaches us that long exposure to the X-rays is not desirable, but this is not so with arc light energy. The patient is placed on an operating table and through a glass speculum the cervix is brought into view. The table is now wheeled so that the arc light apparatus (marine searchlight), mounted on its stand, focusses a strong beam of light from a distance of a foot to

18 inches, down the speculum upon the cervix for twenty minu each day. Such treatment may occupy the days upon wh the X-ray exposures are not given, and it will be found t the former helps rather than hinders the beneficial effect of latter. Another useful way of applying the arc light is to whole surface of the abdomen over an area of 10 or 12 inc in diameter. Painful uterine conditions are mitigated, hæm rhage is controlled, and a state of well-being produced wh is fully worthy of the time and trouble expended upon treatment (*see also* treatment by Radiant Heat and Hot p. 316).

A. PRIMROSE WELL

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[2] "Deutsche Med. Wochenschrift." Leipz. u. Berl., 1901, XXV pp. 69, 87.

MASSAGE.

Manipulations similar to those we now call "massage" have been practised ever since the dawn of history; and we can assume that ever since living beings experienced the sensation of pain, rubbing—as being the nearest remedy—has always been resorted to more or less instinctively. Hippocrates and Celsus made some attempt at discriminating between the actions and effects of different manipulations, but as, previous to the time of Harvey, only the very vaguest notions prevailed in regard to the circulation, such efforts were bound to be fruitless.

It is remarkable, however, that even after Harvey's epoch-making discovery comparatively little speculative thought or attention was given to massage as a dynamic remedial agent; and it is still more remarkable that, although the technique of massage in all its manifold applications was at the height of its popularity (especially in France) during the last century, yet all of the more important physiological facts, which underlie and give this natural remedy its scientific value, should only have become known and appreciated in our own time, mainly through the works of Professor Mosengeil, Zabludowsky, Metzger and others.

Massage is the generic term for quite a variety of manipulations whose cardinal principle is, in one form or another, pressure. Pressure of varying intensity, applied and produced in various ways to suit the anatomical, physiological and pathological conditions of any part of the body.

These manipulations have been needlessly divided and subdivided until classification meant complication and confusion. For general guidance, and for our purpose here, it will be quite sufficient to consider four chief forms of manipulations as classified many years ago, when massage first flourished in France, namely, Effleurage, Petrissage, Friction and Tapotement.

(1) **Effleurage** is a stroking movement with the palms of the hands and with more or less gentle pressure over the surface of the limb towards the trunk. One hand generally alternates with the other, starting from the same point in a centripetal direction along the course of the veins and the lymphatics. This movement or manipulation is quite superficial in character, but it has a great effect on the circulation, as we shall see later

on, and is generally used both before and after the other manipulations.

(2) **Petrissage** is the pinching up of parts of a muscle with both hands, or with the fingers of one hand, rolling them with pressure between the fingers or the hands, and gradually working in this way from below upwards. This has a powerful effect on the deeper circulation, and helps to absorb extravasations of blood or accumulations of effete matter, by breaking up the particles and helping to disperse them. This operation also stretches and loosens fibrous adhesions due to inflammatory conditions, or as a result of prolonged immobilisation of old-time treatment in joint cases.

(3) **Friction** is carried out with the tips of the fingers, and consists of circular movements, gradually advancing with more or less pressure in the direction of the circulation. It is, like petrissage, a complex movement, and is used for the same purpose, but it is perhaps more effective in its action and results.

(4) **Tapotement** is a quick percussing or hammering with the tips of the fingers, the palms of the hands, or with the ulnar border of the hands, applied alternately. It has a decidedly stimulating effect, which is followed by a dilatation of the blood-vessels and a somewhat superficial hyperæmia.

(5) In addition to these four varieties we may mention **Vibration or vibratory massage**, which can be done by hand, or, better still, by special mechanical appliances. This is a more modern addition to the ordinary massage system, and consists of short jerky movements in rapid succession applied in close contact to the body. This subject is dealt with in a special article (*see* Vibratory Massage).

The medical operator, who is guided by physiological considerations, easily finds out the more suitable manipulations for each of the various pathological conditions with which he may have to deal, and he will be able even with less perfect technique to render more valuable services to his patients than a skilful quack operator, who only follows mechanical routine work. In fact, it is only since medical men have taken up the practice of massage that its importance and far-reaching utility have been established in all branches of medicine and surgery.

The physiological action and effect of massage are more or less determined by the dynamic character of the various manipulations employed. The circulation is primarily affected, and with this the condition of the blood, the muscles and nerves, the various internal organs as well as the general metabolism.

Alternating pressure and relaxation in the direction of the circulation as carried out in "effleurage" move the blood and lymph onwards, and a fresh supply is drawn out of the adjoining capillaries and lymph spaces to fill up the vacancy caused. This applied over a large surface of the body has an important accelerating effect on the entire system of circulation.

The experiments of Lassar, Ludwig, Hoppe-Seiler and others show that the large cavities of the body, the joints and the serous membranes are in close connection with the lymph circulation, and we easily understand therefore that massage, by its powerful suction action, helps to absorb intra-capsular and intraparietal accumulations of fluid. Professor Mosengeil's experiments are very interesting in regard to this. He injected a syringeful of Indian ink into the knees of a number of rabbits and then had massage performed at intervals, but only on the right knee. After twenty-four hours the rabbits were killed, and it was found that the ink was still in the left or unmassaged knees, whilst it had entirely disappeared from the right or massaged knees. The lymphatic glands on the right side were full of particles of Indian ink, but those of the left were unaffected.

In regard to muscles and nerves, massage acts as a physical stimulus, and in the healthy subject follows Pflüger's law of nerve-excitability as formulated by Arndt: Weak stimuli increase, while strong stimuli diminish power and vitality. Now, as disease always means diminished power and impaired vitality, we must remember that a stimulus, which in health is just strong enough to excite a healthy reaction, would in morbid conditions be, perhaps, altogether out of proportion.

The effect of massage on the vaso-motor nerves is demonstrated by the dilated superficial blood-vessels and the concomitant hyperæmia of the superficial tissues. This is of great importance for therapeutic considerations, as a depletion of congested internal organs must necessarily correspond with the superficial hyperæmic conditions.

Muscular vitality is greatly increased by massage, as Zabludowsky has shown in his experiments. He exhausted the contractile power of muscles by rhythmical applications of induction currents, and found that kneading the muscle, by carrying away its waste products, restored the power quickly, while rest alone had little restorative effect.

This important action of massage in dispersing the waste products, and at the same time drawing fresh blood to the tissues, has a great effect on the general metabolism. In fact, Weir-

Mitchell and others have found that all metabolic processes are greatly stimulated for hours after a general massage of the body. They have given statistics showing the increase of the excretions, etc., but as in all vital phenomena, such figures are often misleading, and are by no means so convincing as the subjective symptoms, such as improved appetite, increased muscular strength, better sleep, etc., as experienced after a course of massage.

The physiological effect of muscular exercises is similar to that of massage, and it will be readily seen that they constitute a most important form of auto-massage. Each contraction of a muscle presses the blood and lymph out of its tissues into the adjoining veins and lymphatics, just in the same way as hand massage would do. Sir Lauder Brunton says: "At each relaxation of a muscle it tends to cause a vacuum within its surrounding fascia, into which the lymph flows from the muscular structure. At each contraction the muscle presses the lymph out, and these alternating muscular movements really act as a subsidiary heart." This explains the importance of exercise for the circulation, and consequently points to the undoubted utility of massage as a substitute for exercise in conditions of illness or debility.

This effect on the circulation, however, is more pronounced the more thoroughly a muscle is made to contract. Only when fully contracted, like a hard-pressed sponge, can a muscle empty itself completely of its fluid contents. This explains why better results can be obtained in this respect by systematic exercises, according to the Swedish method, in which the contractions and relaxations of muscles are systematically carried out to the full extent, than by ordinary exercise.

Other phenomena of auto-massage, in which the principle of massage is being utilised and carried out by nature itself for the benefit of the body, have been pointed out by Professor Kronecker and Heinricius, who show that the movements of deep respiration have an automatic massage effect on the heart. My own experiments (carried out under Professor Kronecker) have proved that the alternating contraction and relaxation of the walls of the blood-vessels, caused by the pulse wave, are essential to the maintenance of the circulation in the arterial walls, and thereby of their natural elasticity.

THERAPEUTICAL INDICATIONS.

The therapeutical indications of massage are numerous, either as a treatment by itself or as an adjuvant to other treatment, or for the treatment of symptoms. In the majority of cases we rely on its purely mechanical effects. This is particularly so in surgical cases, when we have to deal with sprains, effusions of blood or other similar swellings. For this purpose we commence our manipulations at the circumference of the swelling, so as to relieve the congestion and disperse the blood particles; then gradually as the swelling subsides, and so far as the pain allows, we approach the centre. In more chronic cases, where the effusion is more or less organised, greater pressure is required to disintegrate and break up the solid particles, so as to facilitate their absorption by the lymph stream. Pain can be entirely avoided in this way, and if there has been pain, it is soon relieved by the resulting disappearance of the congestion. Effusions into joints are well adapted for this treatment, and in such cases effleurage has to be applied all round the joint in the direction of the circulation, so that the suction effect of massage disperses and carries away the accumulated fluid. Active and passive movements should, however, be early applied in all joint cases, so as to obviate the danger of atrophy and shortening of muscles and ligaments consequent on prolonged inactivity.

Stiff joints have often followed fractures—not, indeed, as a direct or necessary result of the injury, but rather as a consequence of the old-fashioned treatment by immobilisation. The matting of the soft parts (as described by Sir William Bennett [1]) at the seat of the fracture causes stiffness and pain when the patient begins to use his limb again. This cannot have taken place if massage and gentle movements are used at an early stage. Massage in the treatment of recent fractures is of the greatest mportance for the normal function of the limb, not only in removng the effusion of blood and prevention of adhesions, but also n aiding the formation of healthy callus, consequent on the mproved circulation and better supply of fresh blood.

Early movements are, as we have seen, equally important; and particularly so in fractures near or in a joint, as these are more liable to subsequent stiffness. Gentle effleurage should be applied, possibly from the very first, for about fifteen or twenty minutes ach day, in all cases of fractures without complications and without too great a tendency to displacement of the fragments. This, if properly applied, has a remarkably pain-soothing effect, so that after a few days, passive and active movements of the joints, above and below the fracture, can be carried out without causing pain. In this way all the muscles surrounding the fracture are moved and remain in healthy condition; no matting takes place, the joints are prevented from becoming stiff, and the interrupted local circulation is gradually restored. The limb has, of course, to be well supported whilst this is done, to prevent undue movements of the fragments. Slight disturbance of the fragments has, however, no bad effect, but rather tends to hasten the formation of the callus, and is for this reason even resorted to in cases of delayed union. Massage in ordinary cases does not necessarily promote the formation of callus or shorten the usual period required for the union of the bone, but the great advantage of the treatment consists in safeguarding the function of the limb, so that when the bone is healed and the limb used again there is neither pain nor stiffness. A further advantage is gained, in that the part is daily under observation, and any slight displacement can therefore always be rectified in time.

Lucas-Championnière [2] wrote a most exhaustive treatise on this subject in 1895, but the method had been practised long before this in Sweden. I introduced this treatment into England, and demonstrated it at King's College, St. Thomas's and St. George's Hospitals in 1896.

Non-traumatic joint affections are—excluding inflammatory and septic conditions—generally well adapted for massage treatment. Chronic synovitis, with or without implication of the bursal synovia, and rheumatoid arthritis in its many forms, furnish by far the largest number of cases presenting themselves for treatment. In such we have to deal with an accumulation of serous fluid in the joint, hypertrophic changes in the synovial membrane or its fringes, and with fibroid degeneration of other structures in the joint, the exact conditions depending on the length of time the trouble has lasted. The earlier these cases come under treatment the greater is the prospect of stopping the progress of degeneration, because the less damage done to the tissues, the more chance there is for the reconstructive power of massage to take effect. I should like, however, to emphasise the fact, that it is unwise to rely altogether on the effect of massage alone. In rheumatoid arthritis, for instance the use of local hot-air applications (such as the Tyrnauer bath) to induce intense hyperæmia, followed by passive movements, will be found most valuable adjuncts to the treatment.

In connection with joint troubles I should like to draw attention to a certain condition, which is comparatively seldom diagnosed, although I have reason to believe that it is by no means rare, I refer to a circumscribed form of synovitis, where the patient complains of an obscure sort of pain, which he rarely localises, but describes as a tenderness or discomfort all round the joint. The diagnosis is not easily made unless we examine the joint very carefully and find by palpation a small tender spot of which in most cases the patient is quite unaware. Gentle massage and vibrations over this spot relieves the pain and removes the cause of the functional disturbance.

Mild applications of massage are very beneficial in both the serous and crepitant forms of **teno-synovitis**, and in acute and chronic **muscular rheumatism**. The surprisingly quick relief of pain, which sometimes follows this treatment, is explained in part by the mechanical action of pressure dispersing the exudations, but to some extent it is due to reflex action affecting the sensory nerves.

Frequently we have to make use of massage as a symptomatic treatment in troubles due to weakness or obstruction in any part of the **circulatory system**; for instance, in œdema of the legs and varicose ulcers, etc. Its employment in cases of phlebitis and leg ulcers has not been so general or popular as it deserves to be, but there is no valid reason, why massage should not be used in such cases, provided the necessary precautions are taken. I have had a large number of such cases, and I can testify to most gratifying results. Many of these patients, who were considered chronic invalids, had the use of their limbs restored under the massage treatment. At first only gentle effleurage manipulations should be applied, centripetal and at a distance from the ulcer or the thrombus, to improve the circulation in the limb. This leads to a better nutrition of the tissues, the clot organises, becomes more and more adherent to the walls of the blood-vessels, and ultimately gets entirely absorbed. The ulcer benefits in the same way under the improved conditions of the circulation, and begins to show a greater tendency to heal. As the conditions improve the massage can be carried out more and more effectively and nearer the dangerous zone, until at last the whole limb can be manipulated freely.

Massage of the neck, although so beneficial in effect, has also received but little attention. The operator stands behind the patient and, placing a hand on each side of the neck, gently presses downward from the ear and mastoid process in the direction of the venous blood stream. The sources of the jugular veins and lymphatics are thus affected, the circulation in the brain and its membranes is improved, and congestion of the naso-pharyngeal structures can be effectually relieved. This should be done for five or ten minutes, and can be repeated several times a day.

The action and effect of massage as a therapeutic aid in derangement of the nerves and nervous system have not yet been determined scientifically, but in this, as in other departments of therapeutics, we must gain further experience before attempting scientific explanation. In peripheral affections of the nerves, whether of a traumatic, inflammatory or rheumatic character, the value of massage is undoubted in combating the effects of paresis or paralysis. By its use we can prevent the degeneration of the muscular tissue and lessen the tendency to contraction till nature itself restores the function of the nerves. Some authorities are against the use of massage in acute neuritis. For my own part, I must say I have had, almost without exception, splendid results in such cases; but here, too, I generally also have recourse to local hot-air applications in addition to the massage. In spinal paralysis, such as results from poliomyelitis or tabes, and in the paralysis from cerebral apoplexy, we have of course, less favourable conditions for its employment; but even here much useful work can be done, as a great deal of muscular power and sensibility can often be restored and contractures of muscles and joints prevented by prolonged treatment.

In neuralgias we make use of massage for its sedative effect, and in many cases very great relief is afforded, though its exact physiological action in such conditions has not been satisfactorily explained.

Sciatica and other forms of painful neuritis are, it must be remembered, mostly indications or phases of constitutional derangement or disturbances due to various causes. In such cases we must find out the cause and treat accordingly. Massage is here often beneficial as an auxiliary or symptomatic treatment, which in the hands of a skilful operator soothes the pain, assists the circulation and promotes nutrition in the affected limb. A useful procedure in cases of sciatica is to apply vibratory massage by the hand along the course of the nerve from the sciatic notch downwards. If adhesions have formed, either in the sheath of the nerve or with the surrounding tissues, it will be advantageous to put the patient on his back, and to raise the affected leg, fully extended at the knee-joint, toward the patient's chest. In this way the nerve and adjacent tissues are stretched and adhesions broken down or minimised.

So, too, in employing massage as a remedial agent for such obscure affections of the nervous system as neurasthenia in its many forms, insomnia, etc., we must try to get at the likely cause or causes, and at the same time remember the close relation and reaction between mental and physical conditions as expressed very truly in the old doctrine: "Mens sana in corpore sano."

In disturbances of digestion or disorders of the digestive organs we have in massage a remedy *par excellence*. Dyspepsia, dilatation of the stomach, and constipation are very often due to an atonic condition of the intestines or the abdominal walls. Similarly, liver troubles and hæmorrhoids are often due to a sluggish circulation in the region of the portal vein. In all these cases abdominal massage improves the tone of the external muscles, stimulates peristaltic movements, and considerably improves the circulation in the affected parts.

Gopadse has found in cases of chronic catarrh of the stomach that the percentage of hydrochloric acid, and therefore the digestive power, increases considerably after eight or ten applications of massage. He also noticed that the subjective dyspeptic symptoms were greatly relieved even after two or three applications, on account of the mechanical earlier emptying of the stomach and consequent diminished fermentation.

In chronic constipation, with all its concomitant troubles, such as headache, palpitation, meteorism, dyspepsia, depression, etc., a course of massage is, or to be more correct, ought to be, equivalent to a radical cure, at least in those cases which result from (what in my experience is the commonest cause) atony of the intestinal walls. Sometimes, however, even the most skilful massage has no effect, and in such cases we may find the abdominal muscles relaxed and flabby. Here we must aid massage by a course of abdominal exercises; similarly, if the character of the respiration points to deficient action of the diaphragm, we must resort to a course of respiratory exercises. We must also distinguish the real atonic form of constipation from the spasmodic. Of late years attention has been more and more drawn to a condition of the bowels in which this so-called spasm plays an important part. Langenhagen says: "It is possible to feel some segments of the intestine relaxed, while others in close proximity are in a state of spasm." After my attention was drawn to this, I have frequently come across this condition, and I must say that in such cases I have never succeeded with massage alone. I have, however, found that the galvanic current is here of the greatest service. The anode being placed on the back and the kathode applied to the abdomen, its effect is like that of opium, in that it is sedative, and, in conjunction with massage, speedily relieves these otherwise troublesome symptoms.

There is one point of great importance bearing on the successful treatment of constipation, and that is, that no use whatever must be made of aperients. By habitual taking of aperients an unnatural reflex action is substituted for the natural or normal one, or, what amounts to the same thing in effect, the natural reflex for defæcation is so weakened as to be inoperative. To insure a complete cure this normal reflex has to be re-established, and, in my experience, without resorting to drugs, this is not so difficult of attainment as is generally supposed; though a certain amount of patience is required. There may be no daily stool for some days, yet there is no discomfort, no untoward symptoms, for the massage prevents local accumulations and distensions, and gradually induces a return to the normal and natural function if persevered with. Effective abdominal massage requires a great deal of practice, but the important points are to press firmly, but not painfully, through the abdominal wall on to the intestine, and to follow, in the main, the course of the large bowel. This can be done with one hand or with both (one upon the other), making large circular movements around the abdomen, or with the tips of the fingers, making small circular movements along the course of the intestine. Other finer manipulations may be adopted as one improves in technique, and according to particular conditions that may present themselves. In almost all cases abdominal exercises should form part of the treatment.

So numerous are the applications of massage now in daily use, that to exhaust the subject would be to refer to all branches of medicine and surgery. I have, therefore, confined myself to an outline of the more important indications for its employment.

GUST. HAMEL.

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[1] Bennett, Sir W. H., Lancet, I., p. 359, 1898.

[2] Lucas-Championnière, Traitement des Fractures par le Massage et la Mobilisation, Paris, 1895.

MECHANICAL VIBRATION.

It will be necessary before discussing the claims of treatment by mechanical vibration to have a clear conception of what it consists, and how it differs from other forms of vibration, and other methods of treatment, that seem to belong to the same sphere of usefulness. We can then proceed to show what it is capable of accomplishing, and to describe the technique necessary to bring about therapeutic changes. We have now come to understand that all energy and change is due to vibration of some sort, whether light, heat, sound or electricity. The difference only depends upon the frequency of the vibrations with which they impinge upon the ether occupying all space. We also know that the functions of the body are carried on, and must be entirely dependent upon, the vibrations conveyed to them through the nervous system. The aim, then, of mechanical vibration is to stimulate or inhibit, as it may be necessary, those vibrations that are inherent in our system, and which are true forces of nature. A few words will be necessary to show that mechanical vibratory stimulation differs widely from massage, with which, in the minds of many, it is mixed up. It is well known that a good masseur or masseuse has the power by friction and pressure to stimulate vibrations already going on in the tissues, and, by increasing the flow of blood and lymph to a part, to stimulate the nutrition of a muscle or an organ. All this can be accomplished more rapidly and effectually by mechanical vibration. But the chief aim of the latter is directed, by a more complex technique, to the accomplishment of one primary condition, namely, the stimulation of the nerve centres concerned in controlling a diseased organ. These centres are found chiefly in the spine and sympathetic system. What, then, may treatment by mechanical vibratory stimulation be expected to accomplish? Beneficial therapeutic effects may be looked for by its power: (1) to increase the volume of the blood and lymph flow to a given area or organ; 2) to increase nutrition; (3) to stimulate secretion and excretion, and o the functions of elimination; (4) to act upon muscular and eneral metabolism, and so raise the heat of the body; (5) to elieve muscular spasm and add to its tone; (6) by the regulation f the blood flow to overcome congestions, engorgements and aricosities, and in many cases to remove exudates and the

products of inflammation; (7) to alleviate or remove pain; (8
improve the respiratory functions.

The painstaking work of Dr. Maurice Pilgrim, of New York,
done much to elaborate the scientific application of mechan

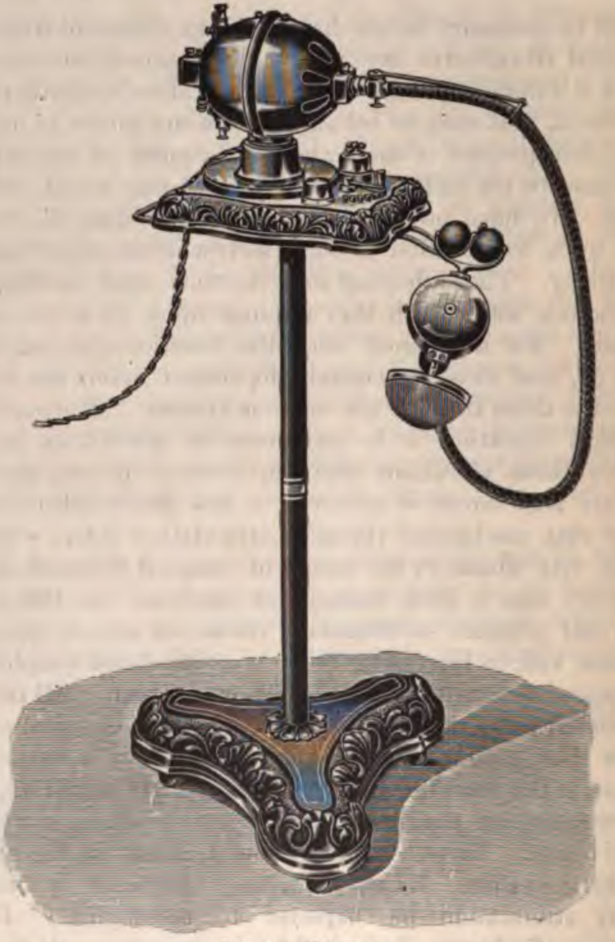

Fig. 1.—Vibrator.

vibratory stimulation [1], and the reader is referred to his book
more comprehensive summary of the whole subject than is pos
in so short an article as the present, and to consult a well-wo
out map within it of the areas in the spinal cord controllin
various organs and parts of the body.

For the practice of mechanical vibratory stimulation all-important that an efficient machine, capable of producing these scientific effects, should be used. Many vibrators have been put upon the market; some are only toys, others are lacking in one or more important particular. I know no machine that is perfect, but there are some that fulfil almost every requirement. The kind I have had in use for some years is figured in the illustration (Fig. 1); certain improvements have from time to time been added. The points that are necessary in the instrument are, first, that it should be of sufficient weight and firmness of build, and that the handle-piece should be distinctly heavy, to enable the operator to hold it steadily upon the part of the patient to be treated, and to convey that amount of weight or lightness in the stroke which is the essence of successful technique. Here I would remark that it is well-nigh impossible for persons to vibrate themselves by means of the many *multum in parvo* machines on the market, for the vibrations of one part of the body get muddled up with those of another, preventing that precision and direction of force that are so necessary to successful effect. The oscillations should be so conducted through the heavy handle-piece (Fig. 2) of the machine that the vibration is applied to that area of the patient which is to be treated, and not escape to the operator himself. It is, further, necessary that it is possible to alter the frequency of the vibrations. And, finally, a variety of terminals, such as are figured (Fig. 4), are necessary to convey the treatment to the various parts of the body.

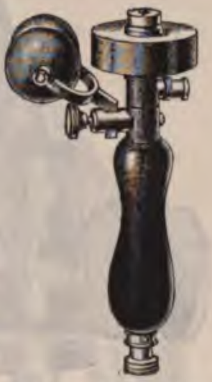
FIG. 2.—Handle-piece, with rubber balls.

THE APPLICATION OF VIBRATION.

The Eye.—The muscular actions of the eye can be stimulated by vibration of the first three cervical nerves; diseased conditions will generally reveal a tender spot lower down in the upper dorsal region, which will require gentle but frequent vibration.

The Ear.—After considerable experience in the treatment of deafness, the writer has come to the conclusion that there are many regions about the ear which should receive attention. In middle-ear deafness, where the chief factor is the welding together of the little bones, due to old inflammatory action, the loosening influence of vibration should be applied all round the ear itself, in the meatus, in front of it, upon the mastoid bone, over the temporal region, at the angle of the jaw, and down the neck between the sterno-mastoid muscle and trachea. The stroke should be light over the bony processes and heavier within the recesses of the muscles of the neck. Such treatment, combined with the stimulation of electricity, is of considerable value when given every other day for three weeks or a month. And not only for old-standing mischief, with noises in the head and giddiness, which so often accompanies it, but for acute catarrhal conditions, gentle vibrations of this sort will be found to diminish the discharge and alleviate the pain. When the semi-circular canals and auditory nerves are involved, vibration over the middle cervical ganglion, in front of the transverse portion of the sixth cervical vertebra, and in front of the meatus will be found useful, but the vibration must be gentle and the treatment long continued. In the above treatment such a terminal as No. 1 of those illustrated (Fig. 4), fixed into the knuckle-joint (Fig. 3) from the top of the hand-piece, will be found most useful, allowing the operator to find his way into the interstices about the ear and neck.

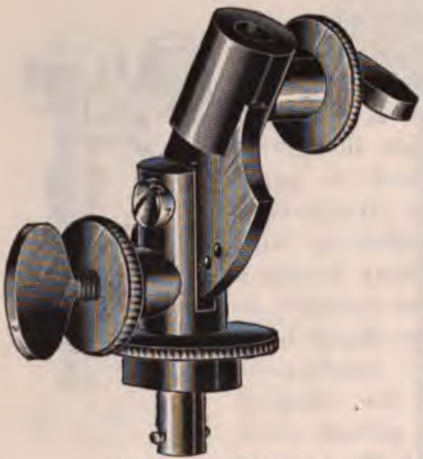
FIG. 3.—Knuckle-joint.

Goître, even of the ex-ophthalmic variety, may yield to vibratory treatment in certain cases. One point, however, must be insisted upon, and this is the thorough stimulation of the lymphatic glands, not only of the neck, but of both axillæ. The liver and spleen should also receive attention; added to this, any sensitive points in the dorsal or cervical region of the spine should be vibrated with the rubber balls and firm pressure, and the goître itself stimulated gently with the brush (No. 3, Fig. 4).

Asthma, associated as it so often is with that which is faulty in the nasal passages or throat, will sometimes yield to vibration because of its beneficial effects upon mucous congestion and abnormal growths in these parts. The writer has been able, with the application of vibratory stimulation to the neck and thorax, to quiet down asthmatic attacks so completely, that the breathing became quiet and regular within a very few minutes.

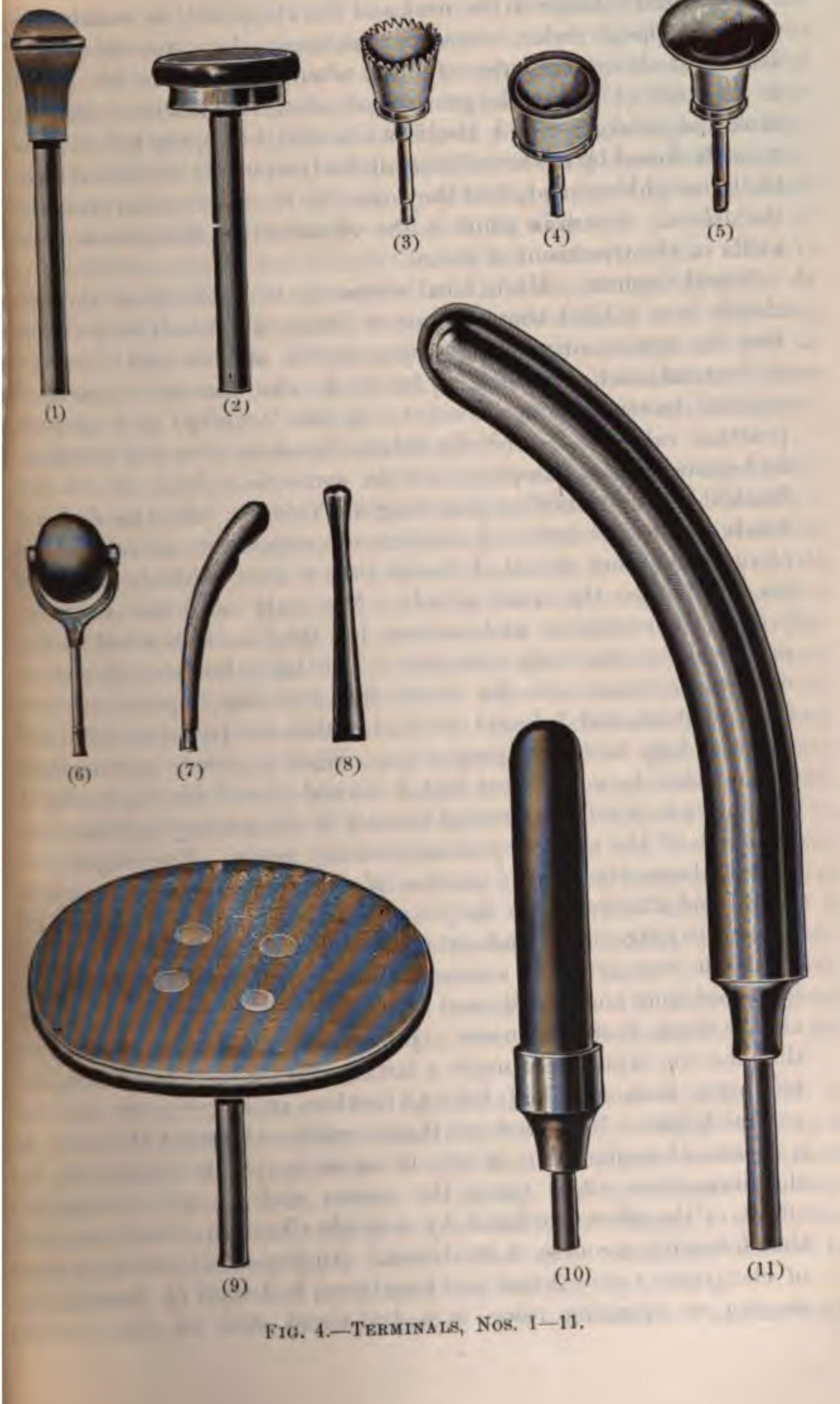

FIG. 4.—TERMINALS, NOS. 1—11.

Enlarged Glands in the neck and elsewhere will, in certain cases, soon disappear under vibratory treatment; but one fundamental fact must always be borne in mind, when an effort is being made to get rid of any enlargement of whatever nature. Not only must the enlarged gland itself be vibrated, but a way for its retreat must be found by the stimulation of the lymphatics and blood vessels in the neighbourhood, that they may do their part in carrying away the *débris*. A case in point is the vibration of the glands of the axilla in the treatment of goître.

Vocal Chords.—Mechanical vibratory stimulation of the vocal chords is a subject that has much interested the writer, who has had the opportunity of subjecting public singers and clergymen to the treatment. It being, so far as he can discover, a new and original treatment, at all events in this country, and of much practical value, he will briefly enlarge upon its uses and technique, and quote from a pamphlet written some time back on "A New Method of Strengthening the Singing Voice." "In the course of treatment by vibration of various ailments, such as catarrh and clergyman's sore throat, I found that a very salutary effect was produced upon the vocal chords. Not only was the voice improved in resonance and volume, but the ease with which it was produced was markedly increased. This led to further experiments upon these lines, with the result that my first impressions were fully realised, and I found we had within our power a useful and effective help to the singing voice. With a view to putting these experiments to a practical test I invited a well-known teacher of singing, who kindly interested himself in the matter, to bring some members of the musical profession to my house. The singers submitted themselves to the process of vibration, singing a song both before and afterwards, in the presence of an audience prepared with himself to judge of any advantage that might be claimed. The experiment was entirely successful, all those treated testifying to increased tone and power, and the facility with which they were able to reach their top notes. In one case a singer assured me that the one experiment made a lasting effect upon her voice, and for some time she had felt a freedom in singing she did not possess before. Now, how are these conditions brought about? As a means of explanation it will be more simple to speak of (*a*) the immediate effect upon the voice; and (*b*) the permanent effect, or the effect produced by a single vibration treatment, and that following a course of treatment. An important factor in cases of clergyman's sore throat and huskiness, and want of tone of the singing or speaking voice, is a dry viscid state of the mucous membrane of the larynx and vocal cords. The fine vibrations of the vocal chords are very dependent on the state of the mucous membrane with which they are clothed, and until this viscid secretion is removed the act of singing is carried on with difficulty. But nature has supplied to the vocal chords a small sack or gland, whose function it is to secrete a fluid to lubricate and cleanse them, and the immediate effect of vibration upon this gland is to bring about such an abundant flow as is sufficient to wash the chords free of the viscid secretion and enable them to act with comfort. This is not the only effect. If a careful and not too violent vibration is applied to the chords it acts as a stimulant to their own vibrating power, and—the fine muscles of the vocal mechanism, as well as the coarser muscles of respiration, participating in the force—causes a delightful feeling of strength and well-being to pervade the singer, who feels that he could fill the Albert Hall."

The results of a course of treatment must be estimated with reference to the condition of the throat. Where, indeed, there is a state of chronic congestion of the larynx and chords, or a debilitated state of the whole vocal mechanism, due to overwork of the parts or anæmia of the system, the results are surprisingly good, and a healthy condition after a time can be confidently looked for. Special muscles can be developed and certain weak notes strengthened, and all methods of voice production helped on.

The technique to be observed in the treatment I have been describing is light stimulating vibration of the glands (salivary and lymphatic) under the jaw and down the neck, even in extreme cases the lymphatics of the axilla (with No. 3 terminal, Fig. 4). The liver and spleen, the vagus in the neck and the vasomotor system as low as the sixth dorsal vertebra may also receive attention (with rubber balls). The writer has never found it necessary to vibrate the vocal chords within the larynx, preferring to apply the stimulation to these parts from without. The treatment should last about twenty minutes in all, being given each morning from a fortnight to a month, according to the severity of the symptoms.

A unique treatment for **Aphonia**, hysterical or otherwise, is found in vibration of the vocal chords, for while the treatment is going on it is impossible for the patients to estimate to what extent they are using their voices, so if they are encouraged to answer questions and the vibration is suddenly stopped, they find themselves talking quite loudly. The same technique should be adopted as that used for stimulating the singing voice.

Combined with the light bath I know no treatment so successful in diminishing **abnormal secretion**, wherever found, as mechanical vibration. Nasal catarrh and chronic clergyman's throat are good examples.

In vibrating **the face** great care must be taken to use a small terminal well covered with rubber, as No. 1, and a comparatively weak vibration, the operator holding the handle-piece very firmly, but with light pressure upon the parts (especially the bony prominences), otherwise very unpleasant sensations are caused. If it is well done, most patients enjoy treatment by mechanical vibration very much about the face and neck, as, indeed, upon all parts of the body. In **chronic bronchitis** the secretion of phlegm is diminished, and the chest calibre improved. The spine from the second dorsal and the intercostal nerves and muscles should be vibrated with the arms extended.

Abdominal Organs.—It is sometimes possible with a few minutes' vibration of the liver to remove the yellow tint from the white of the eyes. The muscular coat of a distended stomach can be toned up, and the increased blood-supply brought by vibration to the part accelerates digestion and prevents the formation of gases. In the same way vibration increases the peristaltic action of the bowels, getting rid of accumulations and helping against constipation. Congested states of the uterus or ovaries should be treated with light, gentle stimulation, which can be gradually strengthened as inflammatory symptoms subside. I invaribly use the two rubber balls for abdominal and chest work, but a very soothing effect in sensitive persons, or where much pain is present, is obtained by the use of a flat, smooth terminal, such as No. 9. The spine in all these affections should also be stimulated, so that the vasomotor centres may be acted upon.

Spinal Curvature.—Owing to its power of improving the muscle tone it will readily be apparent what a valuable part vibration can play in this disease. Groups of muscles can be worked upon until they can again take their part in the support of the spinal column. The treatment is so bracing when applied to the back, with the close proximity of nerve-centres controlling the organs and muscles of the body, that most encouraging results are obtained. The time usually occupied in exercises, beneficial as indeed they are, and the still more tedious treatment of reclining long months upon the already too-sensitive back, can be largely diminished. The single or double rubber ball should be used for this treatment.

The Extremities.—Vibration will be found helpful to the surgeon, for its power to allay the pain and spasm in a recent *fracture* is very comforting. Without removing bandages, a few minutes' gentle treatment from time to time has a temporary soothing effect, and the fracture unites more quickly, so that movement and toning-up of muscles can be used at an earlier period. Vibration is also of value in delayed union of fractures. With *sprains and bruises* the stimulation of the nerves governing them, and the glands which drain them, promotes a rapid recovery.

Neuritis in its various forms will often yield to treatment. This should be applied very gently at first, and chiefly to the cord where the affected nerve is given off. Later it may be applied to the whole course of the cord. Care must be taken in the case of *sciatica*, that all pain and the accompanying muscular contraction are overcome before more vigorous treatment is pursued. Too vigorous treatment at first has the effect of delaying the cure and causes a return of pain and stiffness which more caution might have averted.

In **insomnia**, whether associated with the drug habit or with general nervous irritability, relief can often be obtained, particularly if it is possible to give the treatment late in the evening. The writer has found it best first to vibrate the splanchic region and upper spine with the rubber balls for a few minutes, and then to pass on to a soft gliding movement all over the body, as it reclines on the bed. A No. 9 terminal is recommended for this purpose.

It may be considered from what has been said that mechanical vibratory stimulation in my opinion is a "cure-all." This is not my view, but I have become increasingly impressed, from an experience extending over some years, with the great utility of this treatment when combined with that of electricity and light, and consider it the most successful, but least known, of any form of therapy in the present day. In any case, it is a treatment which well repays a careful and painstaking study. If this is combined with a skilful technique, and a true knowledge of the functions of the body, it will lead, in the hands of any practitioner, to reliable and successful results in many instances.

A. PRIMROSE WELLS.

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[1] Pilgrim, M., "Mechanical Vibratory Stimulation," New York.

PHYSICAL EXERCISES.

Physical Exercises have a place both in preventive and therapeutic medicine. The former, and perhaps the most important task of aiding the full and healthy development of the body is usually undertaken under the ægis of the education authority. It is only by frequently repeated full and complete movements duly graduated in intensity and duration that this healthy development is likely to be produced. Under urban conditions and confinement during long school hours the normal life of the child is profoundly modified, with the consequent appearance of a series of minor deformities and deficiencies said to be almost unknown in those leading an outdoor life. Among these may be classed spinal curvatures, deficient chest expansion and co-ordination between the respiratory and cardiac mechanisms, demonstrated by the rapid supervention of breathlessness on slight exertion. The diminished breathing power is also associated with defects of the lymph circulation exhibited in flabby, ill-nourished, though not necessarily underfed, children who often suffer from enlarged tonsils and adenoids, with constant slight catarrhs. Such children show a marked improvement when their physical force is increased by suitably graduated exercise.

In the last few years great changes have taken place in the type of formal physical education given in English schools. Formerly the gymnastics, if any, consisted almost entirely of arm exercises with considerable resistance, whether in the form of dumb-bells, or of the body weight in movements on horizontal or parallel bars, involving long-sustained muscular contractions. The aim was to obtain extreme efficiency in the better individual pupils, while the weaker followed as best they could. Nowadays exercises begin without added resistance, the aim being to ensure harmonious development and elasticity, to improve the worst and raise the general average. The former system tended to produce powerful but inelastic arm muscles, pectorals and deltoids, checking the freedom of the chest movements and encouraging a stooping posture. That all were expected to perform the same task rendered the gymnastic lesson a source of danger to the weakly, and in the strong tended to exaggerate local muscular development and throw a strain on the heart and lungs; hence it is scarcely a matter for urprise that many boys received medical certificates exempting hem from this subject. It was a grave disadvantage that there was no progressive training for the weaklings who, perhaps naturally, also shirked the alternative physical education provided n organised games. Girls escaped these troubles only in so far that no gymnastics were provided, their needs being regarded as amply filled by a few dancing lessons and an occasional walk. Slowly, however, graduated exercise on the Swedish system has permeated the country, and is now found in nearly all girls' schools and a large proportion of boys' schools.

With this change have come instructors and instructresses trained in the elements of child study who realise the greater importance of good positions and correct carriage than of semi-military unison, and have learnt to care for the weakly, adjusting the course to meet their needs.

As a further consequence many weakly children formerly exempted can obtain the gradual training required to fit them for games and their place in school life. In many schools there are special classes for weakly children suitable for those with deficient breathing powers, compensated heart lesions still in need of constant watchfulness, and early spinal curvatures. If a child goes to school at all he is sure to exert himself violently from time to time, and it is better that his strength should be gradually trained and his muscles and heart accustomed to increased exertions. This task can be effectively fulfilled by educational gymnastics.

EDUCATIONAL GYMNASTICS.

The Swedish system of educational gymnastics comprises a series of progressive exercises which gradually build up the muscles and at the same time strengthen the circulatory and respiratory systems.

The motive of the Swedish system is to raise the powers of the whole class uniformly rather than to develop special strength, skill, or agility among the more proficient or teachable.

Starting on a physiological basis, assuming nothing, it gradually works upwards to exercises of increasing difficulty in a systematic manner and definite order, so that in every lesson all parts of the body are involved. Exercises requiring greater effort alternate with those requiring less effort.

Special attention is paid throughout to the maintenance of the erect attitude, the keeping down of the shoulders, and the increase of the expansion and mobility of the chest; thus tending to orrect the effects of injurious postures assumed during daily life.

The various exercises have some relation to the ordinary movements of daily life, so that the muscular co-ordinations which become familiar are not merely those suited to special apparatus. The direct volitional control of movement is inculcated throughout the course. This feature is perhaps most clearly exemplified in the balance exercises, which form a very important element both in work and games.

Every muscle group is given its normal work to perform, the exercises proceeding from the simpler to the more difficult, so that the former directly prepare for the latter.

Full and free respiration is insisted on at all times, and there are no exercises adapted for use in schools which necessitate even a temporary arrest of the respiratory movements.

All movements are carried out to their fullest extent to ensure that as far as is practicable the whole and not merely the part of a muscle is used, thereby increasing at once strength and elasticity and avoiding any risk of unduly increasing the tendon at the expense of the contractile muscle fibres. A complete gymnastic lesson consists of a series of movements in turn affecting the whole body, arranged in definite groups, classified according to their effects and taken in a definite order which experience has shown to give the best results.

The first classification is into four main types of exercises: Introductory, Fundamental, Derivative or depleting, and Breathing exercises.

Introductory Exercises.—These are the movements which prepare the class for the lesson as a whole and constitute the transition from the previous work. In the main they comprise movements of large groups of muscles to improve the blood and lymph circulation before beginning more severe work.

The nature of the introductories should depend on the nature of the work which has *immediately* preceded. If the class has been running about in the class-room or playground during a brief interval the necessary preliminary stirring up of the circulation by fairly vigorous movements of the larger groups of muscles has been accomplished, and the formal introductory movements require to be of a composing nature, such as slow marking time, followed by deep breathing. When, on the other hand, the class merely form up in the room in which they have had their previous lesson or have walked a short distance to the hall and had no opportunity for free play, the introductory movements should be vigorous and should include marching or running, and other movements of large masses of muscles to get the respiration and circulation in trim for the forthcoming lesson.

Fundamental Exercises.—These comprise the main part of the gymnastic lesson and are generally but not invariably taken in the following order: Arch-flexions of the trunk, heaving, balance, shoulder-blade and abdominal exercises, lateral trunk bendings and turnings, jumping.

Arch-flexions are specially concerned in strengthening the muscles of the back by the action of straightening out the dorsal spine. The simpler forms consist in bending the head backwards with the chin drawn in, the anterior neck muscles preventing much movement at the occipito-atlantal joint, the backward movement thus being a straightening of the dorsal curve. In free-standing exercises without apparatus the position of the back in an arch is that assumed in yawning and stretching.

When support is available more intense backward bending can be undertaken.

In its simpler forms this group of exercises exerts a most useful corrective influence against stooping backs and round shoulders. It must be noted that if the bending is erroneously performed in the lumbar spine the corrective effect is largely lost and the frequently existing condition of hollow back is exaggerated.

This affords a good example of the necessity for a suitable costume in order that the instructor may see that the exercise is performed correctly.

In true *heaving movements* the body must be wholly or partly suspended by the arms, though a certain amount of the work may be done by the legs and the abdominal muscles.

It will therefore be seen that these exercises cannot really be carried out without apparatus, and in free-standing exercises arm stretchings have to be used as substitutes.

There are numerous kinds of *balance movements*, all of which lead to a high degree of willed co-ordination and afford an excellent training for general life. They may be taken on the ground, or, if apparatus is available, at gradually increasing distances from the ground, and with progressively diminishing foothold.

The *dorsal* and *shoulder-blade exercises* in free-standing gymnastics consist usually of arm flinging and lunging movements. Where apparatus is available, a common exercise is forward lying on a form, the feet being fixed by an assistant, while the subject raises his trunk as far as possible from the horizontal. These trunk exercises are carried out slowly and deliberately and require and develop considerable strength and control.

The *abdominal exercises* are most important, regard being paid to the importance of a strong musculature in relation to breathing, more particularly expiration and its modifications, such as the speaking and singing voice, to their influence on peristalsis, and to the avoidance of herniæ.

These abdominal muscles suffer more than any others from the flaccidity which accompanies a sedentary occupation. Their development deserves attention throughout the school period, more especially in girls, who in their ordinary life are little likely to give them sufficient exercise and are likely to pay the penalty of this neglect in later years, during and after pregnancy.

Most abdominal exercises require apparatus, or at least plenty of space, so that in free-standing gymnastics for elementary schools their place is taken by high knee-raising in marching and marking time, or by various fancy steps, in which the abdominal muscles are used, or by games, as frog hopping, which have a similar effect.

The *lateral trunk exercises* are of great importance in relation to the movements of daily life and of games; many of the ricks and strains which result from sudden and violent efforts to restore a lost equilibrium are due to a lack of strength and suppleness in the lateral muscles, and to a want of practice in their rapid co-ordination.

Symmetrically and regularly employed such exercises have a great effect in preventing the onset of lateral curvature, which is encouraged by the faulty sitting positions for writing and other work so common in school life.

They consist of various equal and symmetrical trunk turnings and bendings, the pelvis being more or less fixed to ensure that the movements are taken in the intervertebral joints, rather than in the hip or knee-joints. To ensure this the exercises are often taken in the sitting position.

The special character of the *jumping exercises*, which include vaulting, is that attention is paid to the style of the jump, capability of jumping to command from either foot and a proper mode of landing, rather than to the height or distance jumped. Training for actual high or long jumps is a branch of field athletics and not of educational gymnastics, in which no individua may jump higher or further than he can do in entirely correc style. In vaulting, care is taken to use both sides equall and to maintain throughout the exercise a correct position the trunk, head and shoulders.

Derivative Exercises.—These and the breathing exercises to subsequently described have many points in common. They are intended to be interpolated between any two groups of the fundamental exercises to restore the circulation and respiration to their normal level after the acceleration produced by vigorous exercise. The most usual movements are slow marching and marking time, followed by breathing exercises.

Breathing Exercises.—The only real breathing exercise consists in breathing itself, but the combination of breathing with movements of the limbs or trunk in the same rhythm produces several useful effects.

The nature and type of breathing exercise depends on the place in the table and the effect desired.

Deep breathing is taken in the introductories as part of the preliminary muscle massage, that the aspirating effects of the chest expansion may be exerted on the lymph stream, while it also serves to calm and fix the attention of the class. At this period, when none are out of breath, the breathing can be to command and taken by all with a uniform rhythm, provided there is no great difference in the age of individual members of the class. In later stages, when it is being used as a derivative movement after vigorous exercises, the breathing must be taken by each in his own time, when it will serve directly to quiet the circulation, and only later, when both functions are nearly normal, can it rightly be taken to a uniform and artificial rhythm. Such exercises after preliminary quieting movements are generally employed to conclude a gymnastic lesson.

An additional function is served in training the individual to employ inspirations and expirations of approximately equal duration. The chief breathing fault during exercise is a tendency to insufficient expiration, which is in large measure responsible for the emphysema sometimes produced in recruits when suddenly given hard gymnastic exercises without adequate time for progression, especially when they have not had constant training from their school days onward. Such faults are checked at once by an expert teacher of Swedish gymnastics.

REMEDIAL GYMNASTICS.

Remedial or "medical gymnastics," correct, minimise, or prevent *deformity* ; or improve conditions of lowered bodily health, whether *local* or general. In treating local conditions it is often necessary *to* treat the whole body.

It is impossible to ignore massage in considering treatment by exercises, but since it is fully discussed elsewhere in this volume, a little as possible will be said on the subject (*see* special articles o Treatment by Massage and Vibratory Massage).

Gymnastic treatment consists in the administration at definite intervals, daily or otherwise, of a series of groups of exercises. In the Swedish system these are arranged in a definite order, so that on each occasion those requiring the most exertion are in the middle of the series. The exercises in each group are gradually varied so as to become progressively more difficult. Breathing exercises are an important feature.

Exercises affecting all parts of the body are given. The physiological effect of each movement has been thought out and in many cases proved experimentally. These effects concern the organs of locomotion taking part in the movement and those parts of the nervous system called into play. Both respiration and circulation are profoundly affected, and with these metabolism in all the organs and tissues of the body. The local distribution of blood is also influenced.

A convenient order for general treatment is: (1) respiratory movements; (2) movements of the limbs (arm or leg or both); (3) a movement affecting the abdominal organs (generally a passive trunk movement); (4) neck and head movements; (5) side, abdominal and back movements; (6) limb movements; (7) respiratory movements. In addition, breathing movements are given whenever it seems advisable. In all trunk movements the patient must be told when to inspire.

This order cannot always be rigidly adhered to. Where several back movements are wanted these may be interspersed through the prescription. Movements with similar muscle work are not given immediately following one another, to avoid risk of strain.

Both active and passive movements are employed in general treatment. Active movements may be either free or resisted. A resisted movement may be performed in two ways. In the first case the patient performs the movement, *e.g.*, flexes the elbow while the operator resists; in the second the operator carries out the movement, *e.g.*, extends the patient's elbow against his resistance. In both cases the working muscles are the flexors of the elbow. In the first the muscles in working become shorter and are said to work *concentrically*. In the second case, although working they become longer, and are said therefore to work *eccentrically*.

A muscle so weakened as to be unable to contract against the slightest resistance may still be able to act eccentrically, even when it has lost its reaction to electrical stimuli. This fact is made use of in the early stages of restoring the tone of weak muscles.

The term *static contraction* is used when the muscles are continuously employed to keep the body or part of the body in a fixed position against some constantly acting force such as gravitation. Owing to the effect of this continued tonic contraction on the lymph and blood circulation, the waste products accumulate and this form of work is the most tiring.

In giving simple resisted movements, which in the case of limb movements need not be described in detail, a few points are worth attention. A patient will always perform a movement better and the movement will be more isolated if he is placed in as comfortable a position as possible. The grasp in giving resistance should be firm, but with the hand flexibly moulded to the part. The resistance should be suited to the patient's strength, given evenly, and applied in such a way that it tends to lengthen rather than to shorten the limb. If trembling or jerking arises during a movement the resistance is too strong.

An exercise can only be executed to produce prescribed effects when taken from a prescribed *starting position.*

In the following description, the gymnastic terms are given, since prescriptions of exercises are most conveniently written by the use of a definite and brief nomenclature, which gives directions in the shortest possible way for the position of the trunk and limbs.

The *fundamental starting positions* are standing, kneeling, sitting, lying, and hanging.

(1) **Standing.**—The patient stands erect, with feet forming an angle of 30 degrees to 45 degrees, knees hyper-extended. This attitude should be corrected from below up. The position of the pelvis is most easily corrected by making the patient contract the abdominal muscles and straighten the lumbar spine. The shoulders should be drawn moderately backwards, so that the scapulæ lie flat against the back of the chest. If the shoulders are drawn too much back lordosis is apt to arise. The arms hang by the sides and should be fully extended. The head should be held erect and the patient should make an effort to raise the crown of the head and not the chin (*see* Fig. 1).

(2) **Kneeling.**—Kneeling with thighs upright, feet plantar-flexed. The rest of the body as in standing position.

(3) **Sitting** would appear to merit no description, but in the gymnastic sitting position the whole length of the thigh is supported and the soles of the feet rest on the ground while the legs

are at right angles to the thighs. The upper part of the l
upright.

(4) **Lying.**

(5) **Hanging.**—The patient grasps a bar with the hands pr
and at least the width of the shoulders apart.

When the position of the trunk or limbs is changed in ar
the position becomes a *derived position*. In all the funda
positions except hanging the position of the *arms* may be cl
to the following:

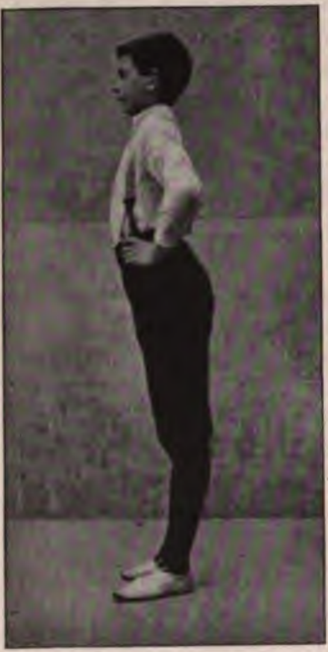

Fig. 1.—Wing-standing.

Hips-firm or **Wing.**—The
are placed on the iliac crests,
in front, thumbs behind.
shoulders are drawn back ti
upper arms are in the same v
plane as the clavicles. By pr
the hands against the crests
easy to straighten the spine. I
a feeling of steadiness to the
part of the trunk and makes
movements easier (*see* Fig. 1).

Neck-firm or **Rest.**—The
of the hands with tips of finge
touching each other are plac
the back of the neck and head.
wrists must be neither flexe
extended, so that the hands an
arms are in the same straigh
elbows back, head well u
back.

Stretch.—The arms are str
upwards above the head, pal
hands facing each other.
patient should at the same time make an upward stre
effort.

Reach.—Arms stretched forwards, parallel to each other
right angles to the trunk, palms facing each other or
downwards.

Yard.—The arms are stretched sideways at right angles
trunk, the palms being turned downwards.

Heave.—From the yard position the arms are rotated ou
and the elbows flexed to a right angle, the forearms
vertical.

If in any of these positions the hands grasp a bar or support, the word "grasp" is added to the description, as **Yard-grasp**, **Heave-grasp** (*see* Fig. 4).

Other positions are derived by varying the position of the *Trunk;* thus if the trunk is allowed to fall forward at the hip joints, standing becomes **Stoop-standing**, sitting becomes **Stoop-sitting.** Sitting becomes **Fall-sitting** if the trunk is allowed to fall backwards at the hip-joints.

In **Turn-standing** the trunk is rotated to one side, the pelvis to some extent moving with the spine, but in the corresponding derivative **Turn-sitting** the pelvis does not move.

By changing the position of the *Legs* the **Standing** position becomes:

Close-standing, the inner borders of the feet being in contact.

Stride-standing, the feet astride being separated by a distance of about one and a half times their length while still maintaining the same angle towards each other. This is a position of great steadiness useful as a base for many movements.

Walk-standing, the patient taking a step forward with one foot, the angle between the feet remaining unchanged. The position is defined by the forward foot, *e.g.*, "Right Walk-standing."

Fall-out-standing or **Lunge**, one foot being moved forward three foot lengths, while at the same time the forward knee is bent till it lies vertically over the toes. The trunk falls forward until it forms a straight line with the posterior leg which is fully extended. The shoulders are square to the front as in the original standing position (*see* Fig. 9).

Variations of the *Sitting* position are:

Close-sitting with the thighs in contact.

Stride-sitting, the thighs being separated so that the knees are about a foot apart, the feet resting exactly below the knees.

Ride-sitting, in which the patient sits astride a bench; the feet may be fixed or supported by a footboard.

Long-sitting, in which the whole lower limb is supported in the horizontal position, the trunk being vertical. This position corrects lordosis (*see* Fig. 4).

The most useful derivations from the *Lying* position are:

Hook-lying, in which both knees are drawn up with the soles of the feet resting on the couch. This relaxes the abdominal walls (*see* Fig. 15).

Sit-lying, in which the thighs are supported, but the legs hang vertically beyond the edge of the couch, the feet resting on the floor.

Half-lying, in which the trunk is supported in a position midway between the vertical and horizontal. The legs may be supported or the thighs only as in an easy chair the feet resting on the ground.

Forward-lying, or the prone position.

Leg-forward-lying, is the prone position with the lower limbs only supported, the feet being fixed by a strap or hand grasp at the ankles and the trunk in the horizontal position beyond the edge of the couch (*see* Fig. 2).

The only derivative from the **Hanging Position** used in medical gymnastics is **Arch-hanging.** To take this position the patient, with the hands pronated, grasps a horizontal bar placed not higher than his head. First one leg and then the other is carried backward so that the tips of the toes rest on the ground, the trunk being at the same time lowered until the arms are fully extended. An arch is thus formed convex forwards, which tends to straighten out the dorsal spine. The position is therefore used in the treatment of kyphosis.

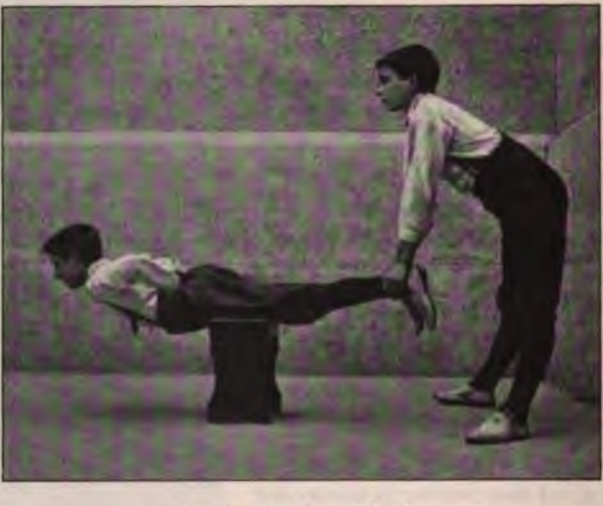

FIG. 2.—Leg-forward-lying.

In the accepted nomenclature for a derived position the words refer in order to the position of the arms, trunk and legs, if each part has to be mentioned, while the last word indicates the fundamental position, *e.g.*, Stretch-stoop-stride-sitting — the patient sitting with arms stretched upwards, trunk bent forwards, legs apart.

EXERCISE IN ORTHOPÆDIC CASES.

Massage and movements play an important part in the treatment of orthopædic cases with or without surgical or static treatment. Treatment by exercises aims at stretching contracted muscles, and at strengthening those which are weak and lengthened. When operative treatment is necessary a better result is obtained if the operation is preceded as well as followed by a course of massage and exercises. Weakened muscles are put into a better condition to undertake their new work. This is shown especially in such cases as wry-neck and club-foot. In many instances where at first sight operation seems necessary treatment by exercises is found to be sufficient.

Wry-neck.—In wry-neck the head is bent towards one side and drawn slightly backwards, the chin being raised while the face is rotated towards the opposite side. The exercises are therefore *head-side-flexion* away from and *head-rotation* towards the affected side, given both passively and actively. In the passive movement the operator gently overstretches the shortened muscles. The active movement is performed concentrically and eccentrically, the patient doing the movement while the operator resists, and then resisting while the operator carries the head back to the mid-line.

If, however, the muscles on one side are much contracted it may be impossible for the patient to perform either movement concentrically. In this case they must be given passively and eccentrically, *i.e.*, in head-side-flexion the operator first bends the head passively as far as possible away from the side of the shortened muscles, and the patient makes an effort to hold it there while the operator carries it back to the mid-line. The head is then rotated by the operator towards the affected side and the patient again tries to hold it there while the operator once more carries it back to the mid-line. *Head-suspension* with the weight resting by the chin and occiput in a Sayre's apparatus is an effective form of passive stretching.

Scoliosis has often to be treated and some free limb and trunk exercises are always advisable (*see* p. 241). If an operation has to be performed and movable apparatus applied, treatment by exercises and massage may be resumed as soon as the wound has healed.

Talipes.—Mild degrees of deformity may be completely corrected by massage and exercises. Contracted muscles are elongated by deep friction and passive stretching. Weak and lengthened muscles are strengthened and shortened by massage, consisting chiefly of kneading and hacking of muscles, and nerve vibrations with concentric and eccentric movements of the weakened muscles. Either operative or static treatment may be combined with the use of exercises.

Taking talipes equinus as illustrating the method, the tendo-Achillis and the plantar fascia are the parts which most obviously require stretching. This may be done by deep friction and by pressing the ball of the toes upwards by hand. The patient may help considerably by making an effort to bring the heel to the ground in walking. The muscles of the front of the leg are exercised by making the patient dorsally flex the foot actively; the operator increases this dorsi-flexion passively and then asks the patient to resist while he draws the foot back to the mid-position. If the patient has worn a boot with a raised heel this can often be gradually lowered.

The treatment of talipes due to infantile paralysis ought to be largely preventive. When the anterior muscles of the leg are weakened the foot drops into the equinus position, unless some method of support is adopted; the simplest being a rectangular splint supporting the sole of the foot or a figure of 8 bandage applied in such a way that the ball of the toes is drawn up. Massage, including vibrations over the nerves supplying the weakened muscles, and exercises should be given twice a day.

In cases where no such precautions have been taken in the beginning, section of tendons is often necessary.

Flat-foot.—In the earlier stages of this condition the foot is everted or abducted, or both. Eversion takes place at the sub-astragaloid joint making the internal malleolus look prominent, a condition which might well be named "knock-ankle." Looked at from behind, the lower end of the tendo-Achillis deviates outwards. The lowering of the arch, and the lengthening and lowering of the inner border of the foot are due to abduction in the lower tarsal joints.

In the stage of eversion the patient complains of "going over" at the ankle, sometimes of pain in the heel (especially in the elderly) or of pain in the knee, which may be enough to arouse suspicion of early tuberculous disease.

The treatment of the causes of flat-foot involves the consideration of rickets, rheumatism, anæmia and of overwork, especially overmuch standing or weight-carrying. A bad habit of walking with the toes turned out, thus throwing a strain on the internal lateral ligaments of the knee and ankle, is undoubtedly a cause. A child walks naturally with the feet parallel and should be encouraged to do so. Walking is performed more rapidly and with less fatigue when the feet are kept straight, an important point for those who walk much.

In the treatment of flat-foot by exercise the most suitable movements are:

Foot-inversion, performed concentrically and eccentrically, *i.e.*, the patient turns the sole of the foot inwards as far as possible, the operator resisting and then forcing the inversion a little beyond what the patient can do. The patient then resists while the foot is carried back to the resting position.

Heel-raising, first with the feet parallel, later with the toes turned in. This should be performed twenty times or more two or three times a day.

Tiptoe Marching with the feet parallel.

Walking on the Dorsum of the outer border of the foot.

Sitting with the Legs Crossed, so that the feet rest on the dorsum of their outer borders.

Inward Rotation of the Hip (concentrically and eccentrically), if the patient walks with the feet much turned out.

Even when mechanical support by an artificial arch is necessary, treatment by exercise is advisable in order to strengthen the muscles.

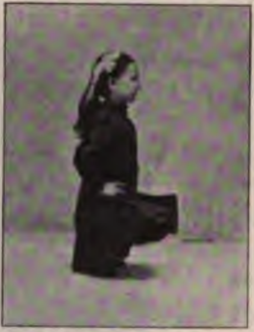

FIG. 3.—Wing-standing, heel-raising, knee-bending.

In the rigid state active exercise is impossible, so that rest and massage are indicated.

Knock-knee.—Preventive treatment is the most important. Slight cases are easily overlooked unless the knees are uncovered. In a severe case it is difficult or impossible to stand with the heels together, but in a slight case the child manages to do so by bending one knee and placing it a trifle in front of the other, an attitude which tends to produce scoliosis. A tendency to flat-foot is always present and must be dealt with as part of the treatment of knock-knee.

The limb is generally flabby and may be improved by massage and exercises. The following are suitable:

Leg Abduction and Adduction, given in the lying or half-lying position, so that the body weight is not on the limbs. The resistance in abduction should be given just above the outer malleolus, in adduction over the inner condyle of the femur.

Leg-updrawing (given in the same positions) exercises the flexors of the hip and knee. The limb is grasped at the ankle, and the foot is kept in the mid-line while the patient draws the knee upward and a trifle outward.

Heel-raising, given as for flat-foot.

Wing-standing, *Heel-raising*—also *Knee-bending* improves the position of the feet and knees. With the heels slightly apart and the toes moderately turned out, the patient first raises the heels as far as possible from the ground and then slowly lowers the trunk while keeping it erect by flexing the hips and knees, without bending forward. The knees are directed outward (*see* Fig. 3).

Spinal Curvatures.—Kyphosis.—Kyphosis arcuata, or stoop, is an increase in the degree of convexity or in the length of the normal dorsal curve, always associated with roundness of the shoulders. The muscles and finally the ligaments of the back become lengthened and those on the front of the chest shortened.

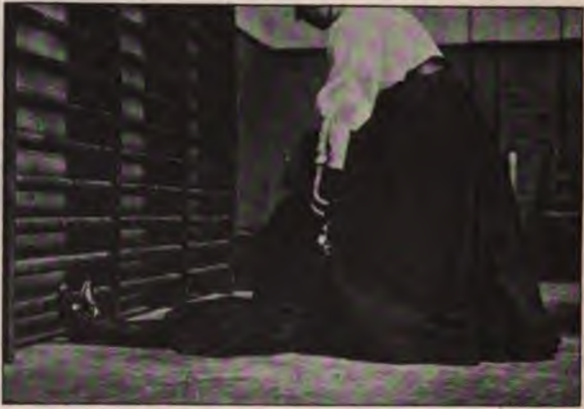

FIG. 4.—Heave-grasp-long-sitting chest expansion.

Treatment of all forms of spinal curvature must include supervision of habitual postures. The use of a sloping desk instead of a table for reading or writing is obviously a preventive as well as a remedial measure. A drawing board placed on a table answers the purpose. The seat should be broad enough to support the whole length of the thighs, but not broader. The back of the seat should have a crossbar at the level of the child's shoulders. The height should be such as to allow the feet to rest comfortably on the ground when the legs are at right angles to the thighs.

Faulty clothing is a common accessory cause, owing to lack of length and width over the chest. Such defects, frequent in ready-made clothing, may be demonstrated by unfastening the garments and placing the child in a corrected position. The use of highboned corsets during adolescence readily produces a stooping position; the front support pressing on the lower end of the sternum causes discomfort, which is most easily and therefore habitually avoided by rounding the back and flattening the chest. Stiff corsets produce a stiff spine and weak muscles, while tight stays especially weaken the abdominal muscles.

Any defects of eyesight or hearing should be remedied.

Treatment by exercise comprises: *Movements which passively stretch* the muscles and ligaments of the front of the body; *movements with active work* for the back and shoulder muscles; *massage* of the back muscles. The tender thickenings generally present in the muscles, due probably to some fibrositis or myositis resulting from overstrain, are removed by massage, which also relieves backache. The tendency of these exercises to produce lordosis, if not already present, must be counteracted by a careful supervision of the position in which they are performed and by giving some exercise to strengthen the abdominal muscles.

I. MOVEMENTS WHICH PASSIVELY STRETCH THE MUSCLES OF THE FRONT OF THE BODY:

Chest Expansions.—These are performed either by carrying the patient's arms backward while the trunk is fixed by pressure in the dorsal region, or by pressing forward the trunk while the arms are fixed. In either case the soft parts on the front of the chest are stretched, the ribs raised, and the position of the shoulders corrected. The positions used as a base for the expansions may be Neck-firm-standing, Heave-grasp-sitting, Heave-grasp-standing, or Stretch-grasp-standing. In *Neck-firm-standing Chest expansion*, the operator stands behind the patient, grasps the elbows from below and pulls them backward, at the same time pressing a small hard cushion, resting against his own chest, between the patient's shoulders. The same form of chest expansion may be performed with the patient sitting on a stool, the operator using his knee instead of a cushion.

In *Heave-grasp-sitting Chest expansion* the operator stands behind the patient, with one knee between the latter's shoulders. The patient's arms are in heave position with the palms facing forward. The operator from above places his arms in front of the patient's, and they grasp each other's elbows. The patient's arms are then carried backward while his back is fixed by the operator's knee (*see* Fig. 4).

In *Heave-* or *Stretch-grasp-standing Chest expansion* the patient may stand between two poles or in a doorway, grasping the poles or the lintels of the door. The operator stands behind, placing one hand between the patient's shoulders to press the chest forward, while with the other hand he draws the pelvis backward by the aid of an encircling strap.

Hanging-with-a-cushion has the advantage that it can be performed without help. The patient hangs from some convenient projection, *e.g.*, two pegs, with the back against a wall, a small hard cushion being placed at the level of the maximum convexity. The stretching force may be increased by intermittent pressure on the lower ribs in front (*see* Fig. 5).

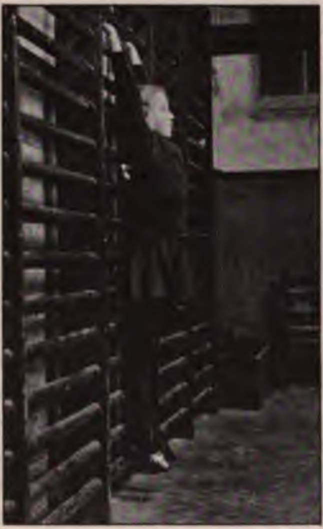

FIG. 5.—Hanging-with-cushion.

II. MOVEMENTS WITH ACTIVE WORK FOR THE MUSCLES OF THE BACK AND SHOULDERS.

Head-bending-backwards with or without resistance.

Yard-standing or *Neck-firm-standing*.—The maintenance of these positions for a short period.

Plane-arm-carrying.—The starting positions generally employed for this movement are Walk-standing, Stoop-stride-sitting and Leg-forward-lying. The operator stands in front of the patient, whose arms are stretched horizontally sideways at the shoulder level. The patient resists while the operator, grasping the wrists, carries the arms forwards. The operator then in turn carries them as far back as possible in the horizontal plane while the patient resists. The arms move in the horizontal plane in whatever position the movement is taken; the muscle work therefore varies slightly.

All *trunk-raisings* fall in this group of exercises, the most useful being the following:

Wing-stoop-stride-sitting Trunk-raising.—The operator standing in front of the patient, places both hands between his shoulders to resist and control the trunk movement. The patient beginning with the back well rounded aims at gradually straightening the spine from the lumbar region to the neck.

Wing-standing Trunk-falling-forward and raising is a free movement. The patient falls forward from the hips as far as he can with a straight back, then raises himself and arches somewhat backward, breathing in while rising, breathing out while going down. This should be repeated three to five times.

Forward-lying Trunk-raising.—From the prone position with the ankles fixed, by the hand of the operator or by a strap, the patient raises his trunk as far as possible.

Leg-forward-lying.—To take the position the patient should kneel at the distance of the length of the thighs from the end of the couch. The feet are then fixed and the patient places his hands on the shoulders of the operator, who carries him down to the horizontal. In returning from this position it is important that the patient should actively flex his hips while pushing off with the arms from the operator's shoulders or hips. If these points are not observed the abdominal muscles are apt to be strained. The position is tiring, both because it tends to fix the chest and because the muscle work is static. To vary it the patient may make a complete trunk flexion, bringing the head down to the ground and rising again. After a little practice this is readily done without help. This differs from the educational exercise only in the amount of support given to the lower limbs (*see* Fig. 2).

Lordosis.—In lordosis there is an increase in the normal lumbar curve, the muscles and ligaments on the front of the lumbar spine becoming lengthened, those on the back shortened. The pelvic tilt is increased, the posterior edge of the brim becoming higher, the anterior edge lower. With this the abdominal muscles and the hamstrings are lengthened, while the hips and knees are hyper-extended. It is important to remember that many cases, apparently primarily lordosis, are really secondary to a lower dorsal kyphosis. Cases secondary to hip-joint disease are not considered here.

An important point in treatment consists in giving the patient a correct idea of the fundamental standing position. If a child is told to stand straight he generally thrusts the abdomen forward and hollows the lumbar spine. The same position results from wearing high-heeled boots.

The aim of treatment is to ensure full and free movements of the back while at the same time shortening and strengthening the abdominal muscles. Suitable exercises include: *Positions and movements producing passive stretching* of the muscles and ligaments on the dorsal surface of the lumbar region; *movements with active work* for the abdominal muscles and flexors of the hips; and *massage* of the external abdominal muscles.

I. Positions and Movements producing Passive Stretching of the Lumbar Spine.

All forward and downward bendings, especially:

Stretch-stride-standing Forward-downward-bending.—The patient standing with arms stretched up and feet astride bends downward and as near the ground as possible, the arms and trunk moving together.

Hewing.—The patient standing in the same position but with the hands clasped, bends quickly forward and downward till the hands are between the legs and again rises, the arms and trunk moving together. The movement is repeated six to twelve times.

Sawing.—From a standing position with feet astride, and the arms held horizontally forwards the patient bends slowly forwards and rises again, at the same time performing a sawing movement with the arms, one arm being quickly flexed and drawn back at the shoulder while the other is fully stretched forward at right angles to the trunk.

Heave-grasp-hook-sitting.—The patient sits on the floor with the back as close as possible to an upright support, such as the end of a bed. The knees are drawn up and a strap is passed round the upright and horizontally round the patient's pelvis and ankles. The patient then grasps the horizontal bar at the end of the bed with the arms in heave position. If kyphosis is also present a small hard cushion is put between the shoulders and the upright. The position should be maintained for from five to ten minutes.

The *Long-sitting* position, in which the whole thigh and leg is supported, straightens the lumbar curve and may be maintained for some time. A child may be told to grasp his toes. Long-sitting is shown (*inter alia*) in Fig. 4.

Downward-travelling on a ladder.—The feet are placed on the lowest rung, the hands grasp one at the level of the shoulders. The feet remain stationary while the hands move alternately downwards.

II. MOVEMENTS WITH ACTIVE WORK FOR THE ABDOMINAL MUSCLES.

Lying-two-leg-lifting.—The patient lifts both legs with the knees straight as high as possible; if the pelvis is also lifted so much the better. The legs are then slowly lowered to the horizontal.

Lying-two-leg-updrawing.—The patient draws up the legs, at the same time bending the knees; while resistance is given by grasping the ankles. The patient then resists while the legs are drawn down.

Wing-lying Trunk-raising.—The patient lies on the back with the hands on the hips, raises the trunk to the vertical and slowly falls again. The head and shoulders should be kept in good position. This movement is easier if the feet are fixed. It is harder than either of the two preceding movements, and should only be given at a later stage of treatment.

Trunk-rotation, either in standing or wing-close-sitting position with resistance at the shoulders, exercises the oblique muscles.

Patients with lordosis should be encouraged to rest for short periods, say twenty minutes, two or three times a day, flat on the back with the knees drawn up and supported by a cushion. If kyphosis is also present a small hard cushion may be placed under the shoulders.

Scoliosis.—Twisting or rotation is an invariable accompaniment of lateral curvature or side-flexion of the spine. The bodies of the vertebræ involved are rotated towards the side of the convexity away from the mid-line, the spinous processes back towards the mid-line, the apparent deviation being thus diminished. Rotation is best seen when the patient stands with the feet apart and nearly parallel and bends forwards from the hips, letting the arms hang loosely towards the ground. If the curve is still purely postural it will become straightened out, while slight but definite curves are made evident, the rotation bringing into prominence the angles of the ribs or the mass of the erector spinæ on the convex side. The lengthened and weakened muscles are thus the more prominent.

The commonest curve is a long single curve convex to the left, which may be suspected if the left shoulder is raised and the right hip prominent. The head may be held to the right. A single curve tends to become double or triple.

The commonest double curve is convex to the right in the dorsal region, convex to the left in the lumbar region. The development of the second curve often minimises the visible signs of the original curve, especially when the patient is observed while fully dressed.

Slight cases of curvature may be cured by remedial exercises, moderately severe cases may be much improved, and even in severe cases the backache may be relieved or cured, the spine and ribs rendered more movable and the circulation and breathing capacity consequently improved.

Some form of spinal jacket is needed when the curvature shows a tendency to increase, but a better result is usually obtained if this is combined with treatment by exercises. Any fixation method, although it may limit or correct deformity, tends to weaken the muscles further, stiffen the spine, and limit the chest movements. Backache is often persistent and troublesome after the supporting jacket is left off.

Definitely one-sided occupations, such as writing or sewing, should only be practised for short periods, say twenty minutes, by young children, and should be preceded and followed by active exercise to counteract their effects.

If one leg is shorter than the other the question of raising the heel or the sole is a necessary preliminary to treatment. Apparent shortening may be the result and not the cause of scoliosis, but even if real shortening is present correction is not always beneficial and should only be recommended after deciding experimentally that it does partially or wholly correct the curve. As a rule, it does so if the short leg is on the side of the lumbar convexity, the curve in this case being due to a compensatory muscular effort. In cases due to infantile paralysis the reverse is often the case, and raising the leg may do harm.

To get the best results exercises should be given daily for from three to twelve months according to the severity of the case. A few simple exercises should be continued by the patient beyond that period.

The aims of treatment are:

(1) To relieve pain by rest, massage and gentle movements.

(2) In most cases to make the spine more movable.

(3) To stretch the shortened muscles on the side of the concavit by passive movements.

(4) To strengthen the back muscles, especially on the side of th convexity by massage and symmetrical back movements as well a by resisted side-flexions towards the convexity.

(5) To increase the mobility and improve the shape of the ches by breathing exercises and by passive and active correctiv movements.

(6) To restore the patient's lost sense of form by symmetrical and balance positions and exercises.

(7) To improve the general health.

All corrective movements in the treatment of scoliosis should be given with the back uncovered.

Movements to Improve Mobility.—*Hanging* by the arms or *Head-suspension* in a modified Sayre's apparatus. Hanging by the arms is often more effective for a dorsal curve when the bar is oblique instead of horizontal, the higher end corresponding to the concave side.

Trunk-rolling, either active or passive. When done passively the patient sits astride a bench. The operator stands behind, places the palm of the left hand on the back of the patient's pelvis and with the other grasps the right shoulder. He then carries the trunk forwards, to the left, backwards and to the right in as large circles as possible, his left hand limiting the movement to the lumbar spine by steadying the pelvis. The hands are then reversed and the movement done in the opposite direction. If the spine is very stiff it is often easier to perform the movement by placing one hand on each shoulder, without trying to fix the pelvis. To perform the movement actively the patient stands with the feet apart and the hands on the hips and circumducts the trunk in each direction alternately.

Head-rolling, to improve the mobility in a cervical curve, is best given passively. The patient fixes the shoulders by grasping a bar, or a child may lie with the head beyond the edge of a couch.

Hewing and Sawing, previously described.

MOVEMENTS GIVING EQUAL WORK TO THE BACK MUSCLES ON EITHER SIDE.—*Head-extensions* exercise the upper dorsal and cervical muscles. The patient fixes his shoulders by grasping the back of a chair, while the operator places one hand on the occiput and with the other steadies the forehead. The patient bends the head back while the operator resists, and then the patient in turn resists while the operator brings the head back to position.

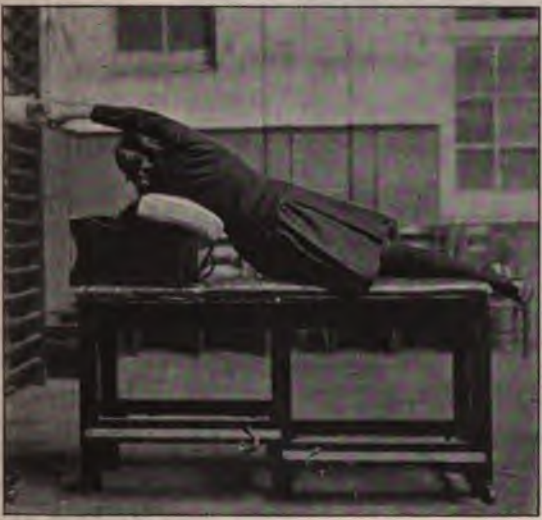

FIG. 6.—Side-lying over cushion.

Wing-standing Trunk-falling-forward-and-raising (*see* p. 238).

Stretch-stride-standing Forward-downward-bending.—The patient, standing with feet apart and arms fully stretched upward, bends forwards and downwards as near the ground as possible, the arms and trunk moving together. A useful movement where the lumbar spine is stiff.

Wing-stoop-stride-sitting Trunk-raising (*see* p. 238).

Grasp-stoop-stride-sitting Trunk-raising.—The operator, standing in front of the patient with his hands supinated, grasps the wrists from below; the patient rounds the back as much as possible and then gradually straightens from below up. After rising two or three times the patient may be rotated to one side as far as possible and rises again from the stooping position two or three times. The movements are repeated to the opposite side and then again from the middle position. The muscles on the side from which the patient is rotated being stretched, contract more strongly, rendering this a useful movement in cases with marked deformity of the back and chest.

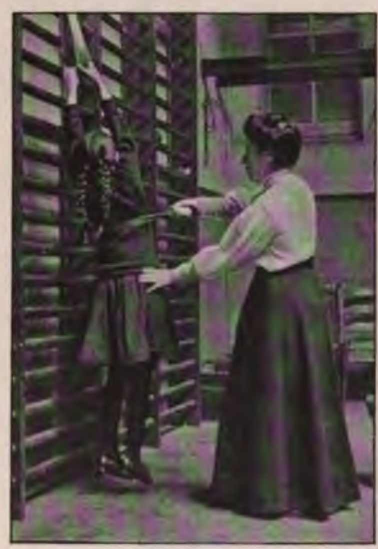

FIG. 7.—Stretch-grasp-side-standing forward-drawing.

Wing-leg-forward-lying (*see* pp. 238, 239, and Fig. 1).

All *balance movements* serve to exercise the back muscles and are easily devised. Walking along a straight line on the floor is the simplest, after which might come walking on a form, the top of a wall, or a rail fence. The position of the arms during this exercise should at first be the yard, then may follow in order of difficulty wing, and, if suitable to the particular patient, the neck-firm or stretch positions. The movement of walking may be varied by lifting the knee as high as possible at each step, and by extending the knee before replacing the foot. The patient should look straight forward, not on the ground.

Movements to stretch the muscles on the concave side and to exercise those on the convex side of the spine are more conveniently considered in reference to the varieties of curvature.

SINGLE CURVES.—STRETCHING MOVEMENTS.—*Side-lying* over a hard cushion, the end of a sofa or other piece of furniture. The weight of the body rests on the supporting surface at the region of the angles of the ribs of the convex side. The arm of the convex side may grasp the lower edge of the sofa, the arm of the concave side is fully stretched over the head and grasps a hand held in a suitable position. The trunk should be so rotated that the weight rests rather behind than in front of the angles of the ribs (*see* Fig. 6).

Stretch-grasp-side-standing Forward-drawing. — The patient stands with the convex side towards the operator and grasps with each hand a loop of a doubled strap fastened to some raised support. The operator, standing behind the patient, pushes him out with a hand placed at the angles of the ribs at the maximum of the convexity, using the other hand to pull the pelvis towards himself, or, standing in front, pulls him out by a strap (*see* Fig. 7).

If the curve affects the lumbar region to a marked extent the following are useful:

Hanging Passive-leg-carrying-to-the-side-with-pressure. — The patient hangs facing the wall. The operator stands behind on the side of the convexity, with the hand nearest the patient fixes the convexity, and with the other carries the legs to the side and a trifle backward. The stretching to be effective must be performed to its limit (*see* Fig. 8). (All pressures should be given with the wrist straight and the fingers flexed at the metacarpo-phalangeal joint to avoid strain.) The same movement may be performed with the patient lying in the prone position, if no hanging apparatus is available, but it is less effective.

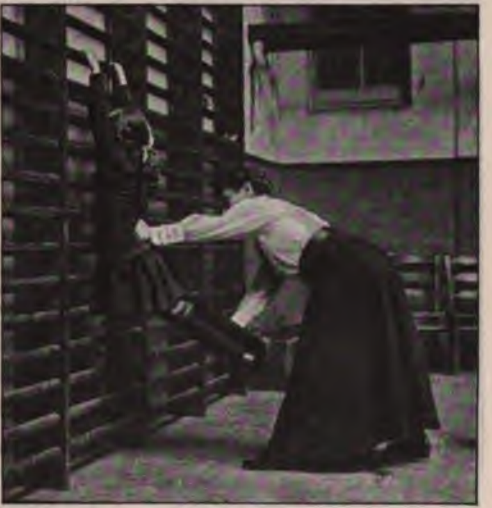

FIG. 8.—Hanging passive-leg-carrying-to-the-side with pressure on lumbar convexity.

Fall-out-standing is an excellent position for correcting a lateral lumbar convexity. The patient falls forward on the leg corresponding to the convexity. If the curve is limited to the lumbar region the arms may be in the wing position, but if it affects the dorsal region the arm on the side of the dorsal concavity should be stretched upward, that on the side of the convexity downward against the thigh. Thus, for a left dorso-lumbar convexity the right arm would be stretched up while the left leg is forward, while in the case of a double curve, left dorsal right lumbar, the right arm would be stretched and the right leg forward (*see* Fig. 9).

Standing-weight-carrying-to-the-side of the Convexity. — If a patient with a fairly movable lumbar curve suddenly bends the knee of the leg on the side of the concavity, transferring the whole weight to the opposite leg, the direction of the spinal curve is changed. This is a useful home movement but must be tested to see that it actually affects the curve, and should be performed before a looking-glass, that the shoulders may be kept straight.

If the curve has been produced by standing on one leg the habit may be allowed to continue for a time if the leg is reversed.

Active Movements for the Muscles on the Convex Side.—These are chiefly side-flexions and leg movements. The subsequent description will apply to a left dorso-lumbar curve.

Right-neck-firm-left-wing-ride-sitting Side-bending to the left with Pressure on the Convexity.—The patient sits astride a stool with the knees fixed by a strap and the feet steady. The operator, standing or kneeling behind, with his left hand firmly presses against the angles of the ribs, while the patient bends to the left, at the same time leaning slightly back against the supporting hand. The flexion takes place above this point. The right hand of the operator grasps the patient under the right shoulder and increases the stretch. A stronger form of this movement may be taken with the patient standing and steadying the right hip against the side of a table.

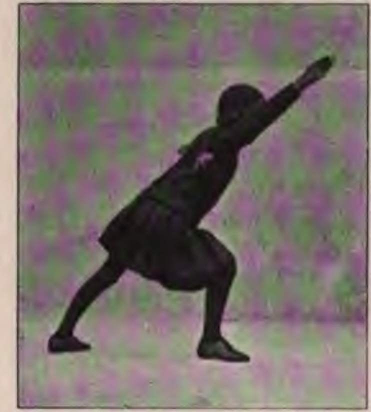

Fig. 9.—Right-stretch-right-fall-out-standing.

Shoulder-lifting.—The operator stands behind, pressing with his left hand against the angles of the patient's left ribs, with his right hand grasping the right wrist to give resistance. The patient raises the right shoulder, at the same time leaning to the left. He then resists while the shoulder is drawn back to the original position. This movement raises the low shoulder, but is chiefly a side-flexion.

Hanging Active-leg-carrying to the Convex Side.—The patient hangs and lifts his legs and pelvis as much as possible to the convex side.

Lying or Standing Leg-abduction toward the convex side.

Lying or Standing Hip-updrawing-with-resistance on the Convex

Side.—The patient first draws up the pelvis on the convex side, the limb being kept straight, and then resists while it is drawn down again. The same movement may be taken without resistance as a home exercise, either in the lying or standing position.

Chest-firm-stoop-stride-standing Side-flexion.—The patient standing with feet apart places one hand, thumb behind, fingers in front, as far back as possible on the chest on the side of the convexity and bends the trunk to the same side, pressing the hand against the ribs. The movement takes place above the point of pressure. After some practice this may be given as a home exercise (*see* Fig. 10).

Wing or Right-stretch-left-walk-standing Heel-raising is a good home movement performed before a mirror. The left walk-standing position corrects a left lumbar curve. Whether the arm on the concave side shall be raised depends on the extent to which the curve involves the dorsal region (*see* Fig. 11).

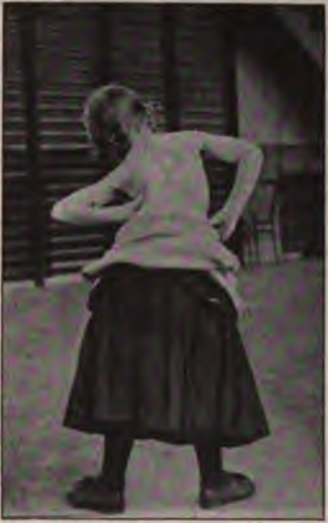
FIG. 10.—Right-wing left-chest-firm-stoop-stride-standing side flexion.

DOUBLE CURVES.—PASSIVE STRETCHING MOVEMENTS.—These are described for a right dorsal left lumbar convexity.

Leg-forward-lying-with-pressure.—The operator stands in front of the patient and helps him down to the position (*see* p. 232). The patient then puts his arms round the operator's hips, his head being on the operator's right. The operator with his left hand presses on the angles of the ribs on the convex side, and with the right hand grasping the patient in the axillary region bends the upper part of the trunk to the convex side. The hand of an assistant may with advantage press on the lumbar convexity at the same time.

Hanging Passive-two-leg-carrying to the side with pressure on the lumbar convexity to correct the lumbar curve (*see* Fig. 8).

Forward-lying Passive-two-leg-carrying to the side with pressure on both convexities. An assistant is needed to fix the dorsal curve by pressure at the angles of the ribs on its convex side. The lumbar curve is chiefly affected.

If one curve is much more marked than the other the movements described for a single curve are suitable.

MOVEMENTS TO EXERCISE THE MUSCLES ON THE CONVEX SIDE OF BOTH CURVES. — *Wing-stoop-stride-sitting Trunk-raising with Pressure on both Curves.*—The operator sits on a chair behind the patient, who sits on a stool, and gives a strong resistance to the raising movement, one hand being on the angles of the ribs of the dorsal convexity, the other on the prominent transverse processes of the lumbar convexity.

Left-stretch-left-fall-out-standing (Fig. 9 reversed).

Left-stretch-left-walk-standing Heel-raising (Fig. 11).

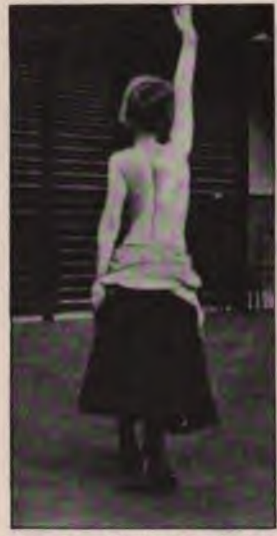

FIG. 11.—Right-stretch-left-walk-standing heel-raising.

FOUR-FOOTED EXERCISES in the treatment of scoliosis were introduced by Professor Klapp, of Bonn. The aim of this method is to mobilise the spine by active movements which at the same time strengthen the weakened muscles. Its theory and value are best understood by watching the method of progression of a four-footed animal, and observing what takes place in its spine. As the fore-leg of one side is placed forward the hind-leg of the same side is stretched back; on the opposite side the fore and hind-legs are placed close to each other near the middle of the body, and the spine becomes convex towards the "open side." As the movement is performed alternately on the two sides the spine is constantly changing its position.

A creeping exercise to produce mobility in cases of single curvature and in slight double curvature is given as follows: The patient, wearing knee-caps of leather, kneels and places his hands on the floor, the arms being outward rotated and fully stretched, the face looking straight forward. He now moves forward his right hand and left knee, alternately with the left hand and right knee, the hand being always placed outside the knee. To correct a C-shaped lateral curve the patient may creep in a circle with the convex side towards the centre of the circle, so that the steps on the outer side are the larger.

In cases of scoliosis the patient's posture during sleep should be enquired into. Where a one-sided posture is habitual and harmful, lying on the opposite side will sometimes help to correct the curve; if this is not the case the patient must lie on the back. With the help of a few hard cushions, or books covered by hard cushions, it is often possible to find a correcting posture, in which the patient may lie for twenty minutes two or three times a day.

EXERCISES IN PULMONARY AND CARDIAC AFFECTIONS.

The effects of treatment by movements are to increase the range of respiration, aid the systemic, portal and pulmonary circulation, render expectoration easier, and, a very important feature, relieve constipation and flatulence.

All forms of movement in which the respiratory action is not impeded are in a true sense breathing exercises. The objects aimed at are to secure full respiratory movements and the passage of air through the nose. In the former connection the value of respiration as an aid to the circulation of the blood and lymph has to be borne in mind.

The classes of case for which they are most useful are *adenoids*, whether slight, or after operation in those of greater severity, conditions of *atelectasis* and lack of expansion so often found in rickety children and those who have suffered from broncho-pneumonia, or the multitude of conditions best described as *localised pulmonary fibrosis*, and the similar condition following pneumonia or pleurisy in adults. They are also useful in the treatment of *heart weakness* from whatever cause this may arise. The former groups are commonly associated, especially in children.

The dangers that may arise in connection with the improper practice of these exercises are on the one hand inspiratory reaction and subsequent chest deformity, and on the other is the development of emphysema, the weakened pulmonary tissues being less tolerant of even the slightest strain. Strain may be thrown on the unprotected parts of the lungs either by prolonged inspiratory efforts or by forced expiration against resistance. This only takes place when the muscles of forced respiration are brought into play and the rhythm of breathing is unnaturally controlled.

Active Breathing Exercises.—Suitable exercises for the early stages of treatment consist in breathing in deeply through the nose, and without a pause breathing out through the nose and mouth. If there is no definite cause of nasal obstruction, such as a prominent spur on the turbinates, the patient may almost at once breath out through the nose only. But if such a cause is present this will not at once be possible, since the obstruction to respiration may be sufficient to determine the onset of emphysema, unless the lung tissues have been strengthened by practice. After a short period of daily practice, five minutes at a time twice a day, breathing out through the nose only should be tried. If this is found to induce slight breathlessness the nose should be examined for the source of the obstruction, which should receive appropriate treatment; meanwhile the exercises should be continued with partial oral expiration. A good way to encourage deep breathing is to direct the patient to stand with the palms of his hands upon the sides of the chest over the lower ribs so that he can feel their outward movement. After a time the breathing which at first should be in the patient's own time, may be made a little slower, and then it may be accompanied by simple arm movements.

(1) The arms are first raised from the sides outwards and upwards to shoulder height during inspiration and carried down again in expiration.

(2) The patient standing in an easy position with the arms hanging by the sides, rotates the arms outwards. In so doing the shoulder-blades are flattened against the back and the front of the chest is lifted. This may or may not be combined with slight backward bending of the head during inspiration.

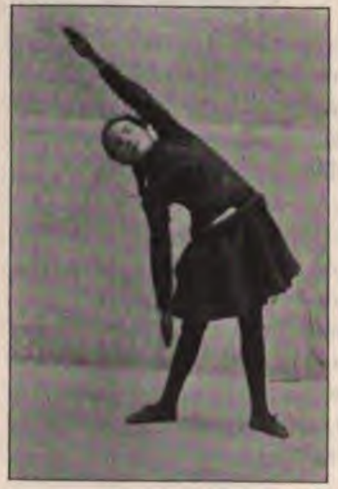

FIG. 12.—Left-stretch-stride-standing side-flexion.

(3) The arms being first stretched forwards at the shoulder level are slowly carried backward during inspiration, and again brought forward during expiration.

The full upward movement from the sides to above the head is not to be recommended as a usual breathing exercise. In all cases the movement should be quiet and uniform, not forced and jerky. It may be repeated in series of, say, eight movements at a time. Common accessory movements in educational gymnastics are to take deep breathing with trunk raising, trunk rotation, or trunk bending sideways (*see* Fig. 12). These can only be advised as breathing exercises at a later stage in the treatment as the accessory muscles are brought into play and the rhythm of respiration is controlled. The chief desideratum is free, deep natural breathing not localised specially in any rt of the chest. To attempt at once to concentrate the ion in the defective area is to throw an undue strain on nctioning air-cells, and perhaps even to undo the beneficial of rest on those which have been injured.

sive Breathing Exercises.—*Chest-lift-stroking.*—This is in the lying or half-lying position. The operator stands in r on one side of the patient and places his hands under the t's back at the level of the shoulder-blades. While the t breathes in the operator gently lifts the chest, at the same rawing his hands downwards. As the patient breathes out erator's hands are carried rds towards each other the lower ribs in front, g expiration by a gentle re. This movement should peated about six times.

st-lift shaking is the same ment with an evenly per-d shaking added while the s are moving forward.

st-lifting is given with atient in the sitting posi- The operator stands behind places a small cushion een himself and the patient's lders. As the patient hes in the operator lifts houlders and then carries backwards, at the same steadying the spine by s of the cushion. The shoulders are then lowered and the ure on the back withdrawn while the patient breathes out (*see* 13).

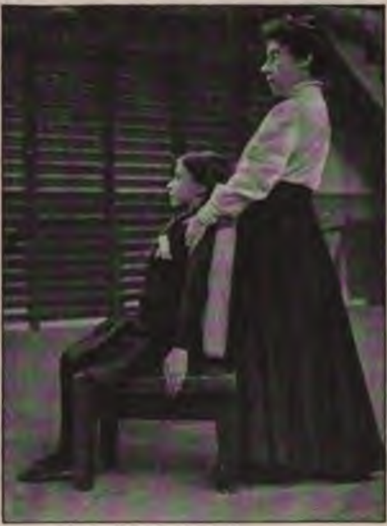
FIG. 13.—Sitting chest-lifting.

uble-arm-rolling.—Standing as above with a cushion between atient's shoulders, the operator grasps the arms by the elbows arries them in a circle forwards, upwards, outwards and down-s (*see* Fig. 14). The patient breathes in while the arms are ng upwards, out while they are moving downwards. In patients ing from heart affections the arms should not be carried much the horizontal.

ronic Bronchitis, Asthma, and Emphysema are benefited est massage and by all exercises which aid both expiration and ration. In these especial attention is paid to expiration, *e.g.*, chest-lift-stroking is given with firm pressure over the front and sides of the chest as the patient breathes out.

Chest-clapping, *i.e.*, clapping with the palms of the hands alternately over the back of the chest often gives considerable relief. Later all passive respiratory movements may be used followed by active movements. In the intervals between attacks of asthma or of bronchitis a mild course of ordinary Swedish educational gymnastics are often of benefit, and by improving the heart and breathing they may materially diminish the frequency of the attacks, while in young subjects the intermissions may become so long as practically to amount to cure.

Trunk-rolling (*see* p. 240).—This aids the portal circulation.

Quick-trunk-rotation.—The patient sits on a stool, hands on hips. The operator, standing behind, places one knee between the patient's shoulders, which he grasps from above and in front, and jerks them alternately backwards, thus producing a rapid trunk rotation. The movement is repeated some ten to fifteen times, when it becomes large and free, and is then allowed to slow down and become smaller.

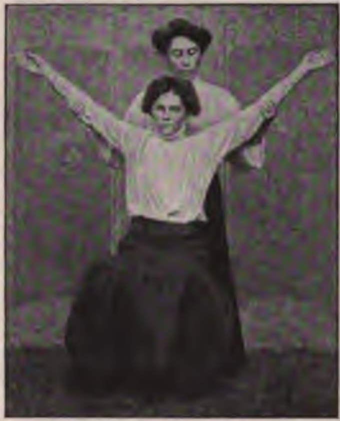
FIG. 14.—Yard-sitting double-arm-rolling.

The duration of the symptoms referred to as **delayed resolution after pneumonia** is sometimes remarkably shortened by a course of treatment comprising massage, chest-clapping and vibrations, and later passive and active breathing exercises, the more energetic passive trunk movements being added gradually.

Exercises help in the restoration of mobility in the after-treatment of **pleurisy**, but should not be commenced until the temperature has been normal for a fortnight, although massage may be employed. The absorption of a chronic pleural effusion may be aided and re-accumulation checked in some cases by chest massage, abdominal kneading and many breathing exercises.

Side-flexions play an important part, but must at first be gentle and only gradually increased in depth. The patient may resist while the operator, standing behind with a hand under one shoulder and the other rather lower on the side of the chest, bends him to one side. The movement is performed to either side alternately. The patient should breathe out during flexion and in while rising.

The movement may be performed without resistance. Two breaths may be taken to each side-flexion, the patient breathing in while bending, out when down, in again while rising, and out when up.

A simple home exercise is for the patient to take deep breaths while sitting sideways on a chair with the arm of the sound side hanging over the back and grasping the seat. The sound side is thus fixed to some extent, and the patient is forced to breathe with the contracted side.

The treatment of **heart affections** by physical exercise comprises massage, baths, active and passive movements, and walking, especially on progressively increasing gradients. These methods are often combined and, though each has its advocates as for a specific mode of treatment, all in reality form part of the common principle of re-educating and readjusting the co-ordinate action of the cardiac and respiratory mechanisms by gradually increasing the work they have to perform. Back-pressure with resulting venous and lymphatic stasis is a common condition, due in part at least to the inability of the patient to make efficient use of the movements of the muscles and of the combination of thoracic aspiration with abdominal pressure to aid the circulation. This condition, which particularly affects the portal vessels and the inferior vena cava, is aggravated by the constipation and flatulence following the lack of abdominal movements. In the early stages of treatment the natural action of the muscles is replaced by the

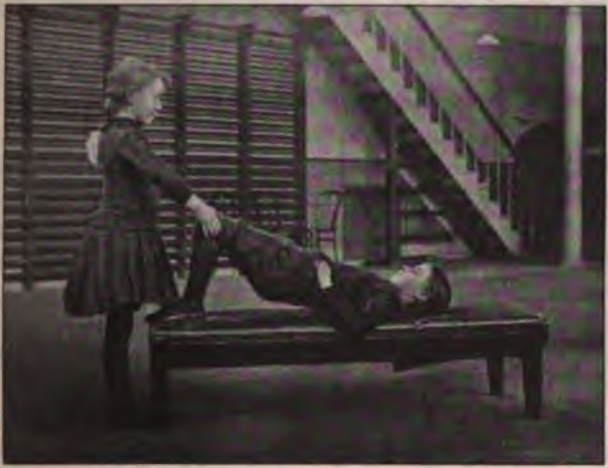

FIG. 15.—Hook-half-lying-knee abduction with pelvic lifting.

pressure exerted by massage and passive movements. Later, in a gradual and progressive manner, active movement is resumed.

Effleurage or centripetal stroking in the direction of the circulation hastens the flow of blood in the superficial veins directly under the hand and consequently in the communicating veins. Muscle kneadings and passive movements have a similar action by alternate compression and relaxation of deeper vessels. All act equally, if not more effectively, on the lymphatics, and so tend to reduce œdema, while abdominal kneadings and passive abdominal exercises aid the circulation, increase the action of the kidneys and relieve constipation.

Suitable respiratory movements are chest-clapping, chest-lift-stroking and shaking, later chest-lifting and double-arm-rolling.

Stimulation of the heart without increasing its work is often attained by massage, hacking or vibrations being given over the cardiac region or down the spine. These have a marked effect in strengthening the beat. Later, gradually increasing work may be given in the form of resisted movements. A beginning is made with foot and hand exercises, then follow in turn elbow, knee and trunk movements. Lower limb take precedence of upper limb movements, as having a greater effect in relieving the right auricle, perhaps because they fix the chest less. All quick movements and shoulder exercises in which the arms are held above the horizontal should be avoided, as must all sudden changes of position.

Only gentle abdominal movements can be given of which trunk-rotation is perhaps the simplest. A common form is for the patient to resist while the operator rotates him to one side and then turn himself forward against a slight resistance. This allows inspiration to take place during the forward turning, expiration while the patient resists the rotation, a pause being introduced for the completion of the respiratory movement.

Easy back exercises are stoop-stride-sitting trunk-raising, the hands being placed on the upper part of the thighs instead of on the hips, or wing-standing trunk falling-forward and raising. Gentle side-flexions may also be given, the patient breathing in while rising.

EXERCISES IN DISEASES ASSOCIATED WITH DEFECTIVE METABOLISM.

Chronic constipation and all the conditions due to or associated with defective metabolism are benefited by general and especially abdominal exercises and massage which ought to include abdominal kneading. This applies to rickets, anæmia, obesity, rheumatoid arthritis, and some skin affections such as acne and chronic urticaria.

Abdominal Exercises.—A *corrected standing position* is for most people an abdominal exercise.

Deep Breathing is also a gentle abdominal exercise.

All *leg exercises* in which the *flexors* of the hips are used may be classed as abdominal exercises. Such are walking, all varieties of marching, especially in combination with knee-raising, running, leg-swinging, the patient steadying himself by placing his hand with outstretched arm against a wall. In double-leg movements the abdominal muscles work more strongly.

In performing abdominal movements the patient should breathe in while raising, out while lowering, the trunk or legs.

Lying-two-leg-lifting (*see* p. 240).—If it is too difficult the patient may begin by lifting one leg at a time as high as possible.

Lying-two-leg-updrawing (*see* p. 240).

Wing-lying or Sit-lying Trunk-raising is a more difficult movement than double-leg-lifting. The feet or knees should be fixed. In raising the trunk from the horizontal to the vertical the head must be kept well back.

An easier variety of the same movement is *Wing-sitting Trunk-backward-falling*. With feet fixed the patient falls back from the upright position as far as he can with a straight back and rises again.

Another variation is *Wing-sitting Trunk-backward-drawing*. In this the patient resists while the operator draws the trunk backwards, grasping by the shoulders.

Trunk-backward-drawing may also be performed in such a way that the trunk becomes arched. For this the pelvis must be fixed. This may be done by the operator's knee, the patient either kneeling or standing. This makes the movement stronger, as the abdominal muscles are more fully stretched and the bloodflow to the abdomen and pelvis is increased by the arch position.

Trunk-rotation exercises chiefly the oblique abdominal muscles. It may be performed in wing- or yard-standing or sitting position, with or without resistance at the shoulders.

Trunk-rotation may be given in combination with trunk-raising, if the operator, standing behind the patient, who is sitting, carries him down halfway to the horizontal, rotating him at the same time. The patient is then asked to rise and at the same time turn forward.

EXERCISES IN CHRONIC NERVOUS DISEASES.

The progress of the **progressive chronic diseases** of the nervous system may be delayed by massage, especially of the back and nerves, and regulated movements, active and passive. In all cases where power of co-ordination is diminished the movements aim at re-educating the nervous system.

Locomotor ataxy may be taken as a type. This disease has for long been treated by physical methods, in most cases with marked improvement lasting for months or years. These patients are easily tired, and a quarter of an hour is generally found to be enough, given twice a day. The doctor or nurse must be the judge of fatigue, not the patient.

Suitable exercises may be given in lying, sitting or standing position according to the patient's condition. Much apparatus has been employed, but most of it can be replaced by simple home devices.

If the patient is in bed he may be asked to touch definite points at the lower end of the bed, first with one foot then with the other, or different parts of one leg with the other foot. Later, having located the spot by sight, he should perform the movement with the eyes closed. Flexion of the hip and knee, followed by extension of the knee, leg abduction, leg circling, may also be performed in lying position.

With each hand he may touch various parts of his own body, with the eyes shut, or may make chalk marks on a slate or black board held in front of him.

From the sitting position the same hand and arm movements may be performed, also foot placings, heel and toe movements. The patient may sit facing a chest of drawers or a set of bookshelves, and may touch various points with the feet alternately, or he may knock down ninepins to order.

Practice in sitting down and getting up is a good trunk, leg and balance movement.

If the patient is able to stand, foot placing movements may be given, first with the eyes open, then closed. Walking along a straight line, then along a zigzag line, walking in a circle, first large then small, all require fixed attention and help re-education. In reversing the direction in walking the patient may rotate on the heel of one foot and the toes of the other. Other exercises are standing on heels, standing on toes, standing on one leg, and walking up and down stairs, using the support of the bannister, and later placing the feet on definite marks.

If the patient cannot stand without help an attendant may give some support by means of a belt or strap attachment, or a walking chair may be used. This consists of a padded frame only three sides of which are enclosed, resting on four legs provided with castors.

In the treatment of the **spasmodic nervous affections** *wry-neck* may be taken as a type.

The aim is to exercise the nerve centres, therefore free movements are given as in educational gymnastics, first under command and supervision, but later practised before a looking-glass. At first it may be enough for the patient to try to keep the head straight while performing other movements; later, arm and other simple movements should be given in combination with head movements. Definitely corrective exercises are better not given unless the case is of long standing with shortening of the muscles of one side, and then great caution is necessary as they may increase the nervous spasm.

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GENERAL PRINCIPLES OF SERUM THERAPY AN VACCINE THERAPY.

ALL infective diseases, whether acute or chronic, represent a w carried on between the complex defensive forces of the body whi are concerned in the production and maintenance of what is call immunity and the invading micro-organism or micro-organis With few exceptions our chief efforts in the treatment of this ty of disease have, until recent years, been largely confined to endeavour to protect the defensive forces of the body from furth attack, and to raise their fighting capacity, that is to say, to ra the "resistance" of the body, by one means or another, such as re the provision of pure air, sanitary surroundings, nourishing fo and the removal or attempt to remove the toxic bacterial produ Owing to the researches of many brilliant workers, especially far as vaccine therapy is concerned of Sir Almroth Wright, we now in a position to attack the cause of many diseases, either means which neutralise the toxic effect of the bacterial produ or by a direct attack on the bacteria themselves. We ha learned that particular infective diseases are due to specific bacte and that if we are to take advantage, from the point of view treatment, of the advances in our knowledge of the cause these diseases we must make an accurate bacteriological diagno This is possible in an increasing number of instances, as for exam diphtheria, typhoid fever, pneumococcus, streptococcus, and gon coccus affections and the other diseases dealt with in the accompan ing article on the Special Applications of Serum Therapy a Vaccine Therapy. In other instances, such as influenza, bronch and nasal catarrh, it is still more necessary to employ the refin methods of the bacteriological laboratory for our diagnosis rath than to rest satisfied with purely clinical evidence, because th are a number of different organisms capable of producing all t usual clinical manifestations of the particular disorder. Th newer methods of treatment, however, are not yet applicable to infective disease for there are certain instances in which we ha not yet obtained accurate information of the bacterial cause, example in rheumatic fever, measles and mumps.

The starting point of our knowledge of these modern methods treatment lies in the law that the introduction of a foreign albun nous substance, which is soluble in the body fluids, into the tissues of a living animal stimulates the tissue cells to form *antibodies* which neutralise or destroy it. An important point, and one on which theoretically the success of vaccine treatment is generally held to depend, is the fact that these antibodies are always produced in excess of the amount required for the immediate purposes of neutralisation or destruction. The introduction of dead or living bacteria is found to stimulate the production of antibodies which are specific. Just as tubercle bacilli are capable of producing no disease other than tuberculosis, so tubercle bacilli or their products when introduced into the tissues of a living animal stimulate the production of antibodies which are capable of neutralising or destroying tubercle bacilli and their products, but which so far as our knowledge goes at present have no effect upon other bacteria or their products. We know that the products of bacteria may be roughly divided into two groups: (1) *exotoxins* or poisons produced in the media in which the bacteria are growing; and (2) *endotoxins* or poisons produced in the bodies of the bacteria and set free on their destruction. In certain diseases such as diphtheria and tetanus the specific bacterium produces chiefly exotoxins; in others, such as pneumococcus and streptococcus infections, typhoid fever and cholera, the specific organism produces chiefly endotoxins.

The antibodies which the defensive forces of the body are capable of manufacturing, to a degree which varies in individuals and probably in the same individual under differing circumstances, are highly complex in their nature, and our knowledge of them is small. We know, however, that the protective capacity of the antibodies may be exerted in different ways. We may have neutralisation of the exotoxins by antibodies called *antitoxins;* direct destruction of the bacteria by antibodies called *bacteriolysins;* or stimulation of phagocytsosis, and in this way destruction of the bacteria, by antibodies called *opsonins*. We take advantage of these facts in treatment. When we have to deal with bacteria producing large quantities of exotoxins our chief endeavour is to use substances capable of neutralising these products. This we can do in a limited number of diseases by a serum which is rich in ready-made antibodies, that is to say an *antitoxic serum*. Such a serum is produced in horses and other animals by the injection of increasing quantities of exotoxins. By the use of a serum of this kind in another animal or man we are said to produce passive immunity. When we have to deal with bacteria producing chiefly endotoxins our desire would be to use a serum which is rich in substances capable of destroying the bacteria (bactericidal substances), that is to say we would desire to use a *bactericidal serum*. Frequent attempts ha been made to produce such sera by inoculating horses or othe animals with living or dead bacteria. Unfortunately sera prepare on these lines, such as anti-streptococcus serum and anti-pneumococcus serum have not hitherto been of much service. In the cas of diseases caused by bacteria producing chiefly endotoxins w therefore attempt to stimulate the production of antibodies by mean of the artificial introduction of dead bacteria (*Vaccine Therapy*), o in other words we endeavour to produce active immunity. In some instances it is advisable to utilise both serum therapy and vaccine therapy either by employing both methods or by using what i called a *sensitized vaccine*, that is a vaccine which has been submitted to the action of an immune serum. Citron has used the last method in the case of tuberculosis, but our experience of it is not yet sufficiently great to enable us to pass judgment on its efficacy.

This brief summary of some of the facts underlying the production of passive and active immunity is sufficient to show that in the treatment of infective diseases we are much better off than our forefathers. It may be said with truth that there are many gaps in our knowledge, but there can be little doubt that in the near future the possibilities of these methods of treatment or others closely allied to them are likely to increase rather than diminish. It is also possible that we shall be able to attack various forms of bacteria directly by chemical means (*chemio-therapy*) as we already do in the case of the spirochaete of syphilis by salvarsan.

SERUM THERAPY.

Antitoxin sera should be definitely standardised in units dependent upon the amount of antitoxin necessary to neutralise 100 times the minimal lethal dose of exotoxin in animals of definite weight. There is no question that if it were possible to produce antitoxic sera for all infective diseases our treatment would be much more successful, especially in examples of acute disease with profound toxæmia. Unfortunately the number of diseases in which it can be definitely shown that such sera are of service is small. Reference is made in the various conditions included under Special Applications of Serum Therapy and Vaccine Therapy to their use in diphtheria, tetanus, streptococcus infections and other diseases, but it must be allowed that although there can be no question of the value of an antitoxic serum in diphtheria and, though to a much less extent, in tetanus, both from the point of view of prophylaxis and of treatment, there is considerable doubt of the value of anti-streptococcus or anti-pneumococcus or other bactericidal sera whether "polyvalent" or not. With regard to bactericidal sera we have at present no method of standardisation, and laboratory proof of their potency is not forthcoming. Clinical evidence from time to time suggests that they are of value, but does not prove that, if they are really responsible for the improvement recorded in particular cases, this depends upon their bactericidal power. It has indeed been suggested that any improvement which does occur is due to such sera acting as vaccines owing to the presence of the micro-organisms or their products used in the attempt to produce immunity. The fact that good results have been reported as to the value of anti-streptococcus serum in a disease due to another organism, namely chronic gonorrhœal affections, suggests that any result is in part due to the serum itself supplying some deficiency of complement or of opsonin, but of this there is no proof.

Administration of Sera.—The usual method adopted is by *subcutaneous injection* in the region of the flank. The needle should be free in the loose cellular tissues and the serum should be injected slowly. Strict asepsis is, of course, necessary. Another method adopted, when symptoms are urgent, is *intravenous injection,* for absorption from the subcutaneous tissues takes time and therefore allows toxins to be fixed and so to get beyond the antitoxic powers of the serum. In some instances sera are given by *rectal injection.* This method is satisfactory, but more serum should be given if it is chosen.

Serum Sickness.—Reference is made to this in the article on Diphtheria (see p. 273), but it may be said here that the production of joint pains, rashes, etc., depend chiefly on the bulk of the serum used. The dosage of sera adopted by different authorities varies considerably. The difference in the doses adopted is due to clinical experience, and probably depends on the fact that many sera are not properly standardised. In diphtheria, for example, in order to obtain the effect of 6,000 units, 20 c.c. of the serum of some manufacturers may have to be given, whilst 10 c.c. of a properly standardised serum is sufficient. It is therefore important that a guarantee of proper standardisation should be insisted upon whenever possible. When serum effects are produced they are easily controlled as a rule by calcium lactate, either in drachm doses (two at four hours interval), or in doses of 15 to 20 gr. thrice daily for a few days. If serum effects of this kind are produced in a patient it is inadvisable to give further doses, as in such instances anaphylaxis is said to be more common.

Horse Serum.—*Fresh* horse serum is held on clinical and on laboratory evidence to have some power in increasing the coagulability of the blood. It is useful, therefore, in severe *hæmorrhage*, and before operations on those who bleed easily. For this purpose, 10—20 c.c. may be given by the mouth preferably on an empty stomach, or by the rectum daily for five to ten days. Fresh horse serum has also proved itself of service in severe cases of *broncho-pneumonia*, although there is no evidence to show the nature of its action. In such cases the administration of 5 c.c. daily for a few days is often associated with a sudden fall of temperature and a rapid amelioration of symptoms. This serum is stated to be of service as a dressing in the case of chronic surface *ulcers*. At one time it was also held to be of value in cases of gastric or duodenal ulcer, but confirmatory evidence has not been forthcoming.

VACCINE THERAPY.

A vaccine is a pure culture of any micro-organism, suspended in normal saline solution, sterilised by heat, and standardised as to the *number*, but not the virulence, of the particular bacteria in one cubic centimetre. By the introduction of vaccines into the tissues of the body we can stimulate the production of specific antibodies. As these antibodies are produced in excess of the immediate requirements and are capable of being held in reserve for periods of time which vary with the particular disease, increasing use of them is made at the present day both in prophylaxis and treatment.

In Prophylaxis.—Vaccines are extensively used at the present day in such diseases as staphylococcus infections, cholera, plague, and typhoid fever (see article on Applications of Serum Therapy and Vaccine Therapy). They are also used by some surgeons before certain operations when there may be considerable risk of infection by streptococci or B. coli. In such cases at least a fortnight's time before the operation is required. Again, it is rather fashionable at the present time to recommend a course of vaccine therapy as a prevention against "colds" and attacks of "influenza." In both these instances so many bacteria are capable of producing the symptoms that treatment by a *stock vaccine* of any bacterium, or even of several, is open to serious objections. A bet plan in the case of persons who suffer from recurring "colds" attacks of "influenza" is to investigate the bacterial flora of the upp part of the respiratory tract at the time of an attack, and thus diagnose the actual cause. A course of treatment extending over a period of two months and repeated at intervals may then be of great service.

In Treatment.—Vaccine therapy has been proved to be of service not only in chronic diseases, but also in acute diseases in which there may be a generalised infection. It is difficult at first sight to understand how the addition of further toxins can be of service in a condition in which there is already an excess of toxins. In the first place, however, when organisms are multiplying in the blood they are not necessarily in those tissues which are the main source of antibodies, and secondly, in a toxæmic condition there is little chance for the rapid production of antibodies, because the bacteria are killed and diluted to such an extent in the blood that their effect is largely toxic and produces little response from the tissue cells, whereas the introduction of a vaccine into healthy tissues produces an immediate response in the shape of antibodies. Again, in the one case the body is dealing with living bacterial protoplasm and in the other with dead bacterial protoplasm. It is therefore possible that some obscure chemical change underlies the results obtained by the administration of vaccines. Whatever the cause, there is no doubt that vaccine therapy has produced in numerous cases of acute infection results which may be regarded as being amongst the greatest triumphs of modern medicine. One essential to the success of vaccine therapy is an accurate bacteriological diagnosis of the cases which are treated. When it is possible to isolate the particular organism by direct cultural experiment the diagnosis is easy. In many cases we cannot have this direct evidence, but have to rely on other bacteriological methods, such as serum reactions and the like. When even this is impossible, a series of opsonic indices under varying conditions of rest and exercise, as in a case of suspected gonorrhœal arthritis, may help us in determining our course of treatment. Again, in a case of bronchitis in which three or more organisms are isolated from the sputum, we may arrive at the causal factor by (1) a series of opsonic indices; (2) a careful study of the immediate past history of the patient, *e.g.*, if the bronchitis follows an attack of influenza and the influenza bacillus is isolated in the bronchitic sputum, it is probably the cause of the condition; (3) the great predominance of one particular bacterium; or (4) actual experiment with vaccines of the different organisms. In all cases experience shows that the use of an *autogenous vaccine*, that is, a vaccine prepared from bacteria isolated directly from the individual patient, is attended with more satisfactory results than the use of a stock vaccine. Unfortunately, there are many cases in which it is impossible to obtain an autogenous vaccine. We then have to be content with a stock vaccine. In some instances the use of an autogenous vaccine is not attended with good results simply because of the low virulence of the particular organisms. In such cases it is advisable to use a stock vaccine of a more virulent strain or mixture of strains. It must be remembered further that vaccines tend to lose their power even if carefully kept in a cool, dark place. Many lose most of their virulence in less than three months; others, such as vaccines of B. coli, may become inert in so short a period as one month. In using stock vaccines it is therefore important to see that they have been prepared recently.

The *length of treatment* varies with each case and each micro-organism. In all cases it is a golden rule to continue treatment for some time after all symptoms have gone. In this way a higher degree of immunity is established and consequently relapses are much less common.

Experience has shown that vaccine therapy cannot be of service in removing *necrosed matter or an abscess;* for example, if we are dealing with an abscess in a gland or with a sinus leading from a necrosed bone, vaccine therapy will aid in combating the infective process, but a cure cannot be expected until the dead and irritating matter has been removed. In such cases surgical measures are required, but these should be simple and the disturbance of the tissues should be kept within the lowest possible limits, unless it is possible to remove the whole focus of the disease. Even with the simplest surgical procedure some disturbance of the tissues takes place which leads to the absorption of bacterial products, and these act in exactly the same way as vaccines. Consequently, further doses of the vaccine should be withheld until the tissues have responded by the manufacture of antibodies and the effects of the dose of the patient's own bacterial products has passed off. The resumption of vaccine therapy at this stage will often hasten the curative process.

Experience has also shown that the success of vaccine therapy depends to a great extent upon the control we may be able to exert in each case upon what is termed *auto-inoculation*, that is, the absorption of bacteria and their products from the focus of the disease into the neighbouring tissues and the general circulation. In cases in which there are a series of irregular auto-inoculations in excess of the capacity for an immunising response, treatment by vaccines will do little, if any, good, and may do much harm. We have, therefore, to do everything possible to limit excessive auto-inoculation. As the amount of bacteria and their products which are absorbed from a focus of disease depends largely on the amount staphylococcus, pneumococcus and other infections. It is often convenient to adopt this method if the hypodermic method is impossible for any reason. If it is adopted care must be taken that each dose is given on a stomach which is empty. This object is best obtained by giving the dose in a little sterilised normal saline solution one hour before breakfast. Vaccines given in this way should be free from lysol or other antiseptics, as these may upset the stomach. This method is contra-indicated if the digestion is disordered or the tongue furred. No food should be taken for an hour after the dose has been given.

Initial Dose.—Particulars are given in the article on the Special Applications of Vaccine Therapy with regard to the initial doses in various affections. We may, however, add a few words on the general principles involved. The size of the initial dose must vary according to the virulence of the organism, and to the nature of the infection, and especially according to whether this is acute, generalised, chronic, or localised. Although vaccines are standardised to contain so many million bacteria in 1 c.c., we have as yet no method of standardisation of the virulence of any particular vaccine. This is an important point, for different strains of many organisms, such as the pneumococcus, micrococcus-catarrhalis and B. coli, have very different degrees of virulence; whilst most vaccines tend to lose in virulence after they have been kept for a period of three months. It is probably due to this fact that authorities differ so markedly about the best initial dose in certain infections, as, for example, acute pneumonia, and that we find in this disorder the initial dose recommended varies from 1 to 30 millions or even more. In the case of stock vaccines previous experience will tell us something about their virulence so that we can estimate the effect of a particular dose and so determine the size o the initial dose. When we are dealing with autogenous vaccines i is always best to begin with a very small dose. If the effect of this is to produce either local or general disturbance we must recognise that the individual patient is sensitive to the particular vaccine and therefore proceed slowly. In no case can we blindly follow rules. It may, however, be said that the more chronic and localised the disease, the larger may the initial dose be, and that the more acute and generalised the disease, the smaller must the initial dose be In certain local conditions it is good practice to endeavour to procure a local reaction as the result of the initial dose. For example in the case of a boil in which suppuration has commenced a dose o 50 to 100 millions staphylococci may have no effect at all, whereas a dose of 500 millions will cause the abscess to slough out and then bring about rapid healing. In acute or generalised infections we are dealing with a large number of organisms or with an organism of high virulence. In either case we have a marked condition of toxæmia. An excessive dose of vaccine will do harm, either by causing too rapid a destruction of bacteria and so throwing a quantity of endotoxins into the blood which cannot be neutralised at once, or it may be, as has been suggested, that the primary effect of such an excessive dose is to "fix" what antibodies have already been manufactured and so, for a time, relieve the invading bacteria from what little check already exists. We must therefore remember that in acute disease vaccine therapy may do a great deal of harm unless the initial doses are very small, and an increase of their size only made when the effect of the vaccine in the particular case is thoroughly grasped. The initial dose in such cases should therefore be of minimal size. Such a dose may do no good, but it will do no harm. The time for the administration of the next dose and the question of its size must be determined on the lines discussed in the next paragraph.

Control and Spacing of Subsequent Doses.—Too large or too frequently repeated doses depress the immunising capacity of the serum and the tissues and so cause an exacerbation of the infective process. The size of the doses and the frequency of dosage are of the first importance. The tendency is to go too fast, but this always produces harmful results. The same thing happens if we are guided by rule of thumb. In certain instances the doses may be increased at stated intervals, or may be rapidly increased with nothing but good results. In other cases small doses at longer intervals, or very gradual increase in the dosage, are necessary for success. For example, in a case of staphylococcus infection the initial dose was 100 million staphylococci; subsequent doses at six-daily intervals were given as follows: 150 million, 200 million, 250 million, 500 million, 1,000 million, with good results. In another case 150 million staphylococci always caused a rise of temperature, but 100 million every ten days for some weeks effected a cure. Again, in a case of B. coli infection any dose above three million caused fever, in another the initial dose was ten million and was gradually increased, with satisfactory results, to 100 million. Everything depends on the immunising capacity of the individual and the virulence and appropriateness of the vaccine. It is therefore essential that we should have a definite guide to the size of the dose to be given, and the intervals to be allowed to elapse between the doses. Many attempts have been made to give us some reliable laboratory guide to the effect of vaccines. The best laboratory method of control is undoubtedly the estimation of the opsonic index, and until recently it was held by many that the proper dose and the proper intervals between successive doses could only be determined by means of frequent observations of this index. Such observations involve great technical skill, much conscientious labour and expense, and are therefore not available for the majority of patients suffering from infective diseases. This is especially the case in acute infections in which auto-inoculation is constantly taking place, for then if we are to derive any real knowledge from the opsonic index, we must have determinations at short intervals. In fact, in such cases observations of the opsonic index may be misleading unless two or more observations are taken daily. A further limitation to the use of the opsonic index as a control is the fact that in the case of many organisms, such as pneumococcus, streptococcus, and micrococcus catarrhalis, the technical difficulties are such that the readings may be unreliable. Fortunately, it has been shown that it is possible to gauge the variations of the opsonic index, that is, it is possible to say whether there is an increase or a decrease in the immunising response, as the result of the administration of a vaccine by a careful study of the clinical symptoms and temperature chart. An excessive dose will produce local effects or general effects. For example, an excessive dose in a case of a localised staphylococcus infection may produce pain and swelling; and in a case of bronchitis may lead to an increase of expectoration and dyspnœa ; whilst in other cases we may have general malaise, headache across the eyes, lassitude, pain in the limbs, and a rise in temperature of some degrees, together with an increase in the severity of the symptoms of the disease. A dose of vaccine which is followed within twenty-four or thirty-six hours by a rise of temperature, or what is equally important, an increased daily fluctuation of the temperature to the extent of half a degree (whether the temperature is raised, normal, or sub-normal), and an aggravation of symptoms, is too large. When this happens we must wait until the bad effects of the dose have passed off, and then give a smaller dose and proceed slowly. If the disturbance has been small, the size of the dose need not be cut down, but the same dose may be repeated. It may now cause no disturbance, and if it does the ill-effects will be less marked. If the disturbance due to a dose is marked, the next dose should be smaller. A dose which has no effect on the temperature or the symptoms is too small, and may safely be increased. A dose which is followed by a lowering of the temperature, or by a diminution in the daily fluctuation of the temperature (whether the temperature is raised, normal, or sub-normal) and improvement in the symptoms, does good. We may therefore safely take careful and complete clinical observation as a guide to vaccine therapy. The necessity of a careful study of the symptoms and the temperature must, however, be insisted upon. In difficult cases the more controls we have the better for our chance of success, and in such instances an occasional appeal to a series of opsonic indices may be of value. In cases of *double or treble infection* it will be found that one organism is usually the dominant factor. It is wisest to commence treatment with this, and, if other vaccines are subsequently given, to administer them on different days so as to be in a position to judge their effects separately, rather than to give doses of a mixed vaccine.

We see then that it is best to commence with a small dose, and then to increase it until it produces good effects or a reaction. If it produces a reaction we must not increase the size of the dose, but, as a rule, must give a smaller one and wait some time before trying the effect of a further increase. When a particular dose has done good, it is best to increase it slightly, as the repetition of the same stimulus does not as a rule produce the previous effect, whereas a slightly larger stimulus will cause a further production of antibodies. The length of time between the doses must depend on the effect of each dose. If the clinical symptoms show, as they often do, that the good effect of the previous dose has worn off, a further dose must be given. As a general rule, minimal doses may be repeated, or an increase made every forty-eight to seventy-two hours; larger doses may be repeated, or an increase made every five to ten days, but in each instance we must be guided by the particular indications of a given case if we are to obtain the best results in the shortest period of time.

Results of Vaccine Therapy.—When the diagnosis is thorough, and proper care is exercised, the results of this comparatively new method of treatment are most encouraging in a large number of instances, and sometimes extraordinarily dramatic. Much more remains to be done before our knowledge on this subject is complete. We must recognise that in many cases failure results, and we must recognise further that our knowledge of the duration of the immunity which we can sometimes establish, at any rate for time, is fragmentary. Nevertheless there can be no doubt that in accine therapy we have an addition of the utmost value to our methods of relieving symptoms and of curing disease. It is, however, necessary to insist that this method does not displace the older well established methods of treatment, and that if we are to obtain the best results we must use it in conjunction with those meth which years of clinical experience have shown us to be essential successful treatment.

ARTHUR LATHAM

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SPECIAL APPLICATIONS OF SERUM THERAPY AND VACCINE THERAPY.

ACNE.

See Volume III.

ANTHRAX.

See Volume I.

ASTHMA.

See Volume I., and Pollantin, Volume III.

BACILLUS COLI COMMUNIS INFECTIONS.

UNDER normal circumstances this organism leads a saprophytic life in the human intestine. In certain conditions, however, it becomes pathogenic to man and may be associated with cystitis, pyelitis, osteo-myelitis, arthritis, otitis media and other affections, or may even be the cause of a genuine septicæmia.

The colon bacillus can be isolated from the urine far more often than is usually supposed, especially in patients liable to chronic constipation, hæmorrhoids, and like conditions. Under these circumstances the bacilli are usually unassociated either with pyrexia, or with the presence of pus cells in the urine. When the bacilli are pathogenic, vesical cells and pus corpuscles are usually, but not always, abundant.

In suspected bladder cases the urine to be submitted to bacteriological examination should always be drawn off with a catheter, otherwise local contamination which is very common in women will often result in the organism being isolated when it is absent from the catheter-drawn specimen of urine.

Treatment of B. Coli Infections with Anti-Coli Serum.—Dudgeon, Mozer, and others have attempted to prepare an anti-coli serum for use in man, but the results obtained after adequate trial are not sufficiently satisfactory to justify its recommendation.

General Remarks on the use of B. Coli Vaccine.—The vaccine should always be prepared from the patient's own organism isolated from the urine or from material derived from the infected area. Stock laboratory vaccines are almost valueless. The use of B. coli vaccine requires experience, care and caution. It is important to realise that autogenous vaccines of the B. coli lose their potency at an earlier stage than most other vaccines. For this reason a fresh vaccine should be prepared at intervals of about a month. It should be administered subcutaneously, or in certain selected cases by the mouth.

The treatment of B. coli infections, both acute and chronic—but especially the latter—is often disappointing, and even when much time and labour have been bestowed, it may be found impossible to remove completely the bacilli from the urine, though the pus may disappear and the general condition of the patient be greatly benefited.

If, after all the acute symptoms have subsided, the organism is still found in the catheter-drawn specimen of urine, then, in addition to the administration of vaccine, the desirability of employing drugs and local treatment may be considered.

Chronic Infections.—For an adult suffering from chronic B. coli infection without pyrexia the initial subcutaneous dose should be one to five million, or if administered orally five to ten million, mixed with about 10 c.c. of sterile saline solution (or with the same bulk of water), and should be drunk by the patient on waking in the morning. When administered in this way special care should be taken that no food or drink of any kind is allowed for one clear hour afterwards. There should be no rise of temperature after a dose. If any pyrexia occurs the next dose should be reduced. In chronic infections the time which elapses between successive doses is often associated with a sub-normal temperature.

The doses should be gradually increased at intervals of five to seven days to ten, fifteen, twenty, forty and sixty millions, and consistent treatment should be carried out for at least two months. Large doses are usually unnecessary, and are apt to cause a rise of temperature and other signs of constitutional disturbance. Patients improve much more rapidly with comparatively small doses given at shorter intervals than with larger doses given at longer intervals of ten days or so. At first the small doses may be repeated every three or four days, the period of time being gradually lengthened out to five, six and seven days as the doses are increased.

Acute Infections.—In acute B. coli infections, especially in acute B. coli cystitis, great care and caution are required in administering the autogenous vaccine. In these cases the colon bacilli are abundant in the urine and much pus is usually present. Catheterisation of the patient or any interference with the bladder during the acute stage is dangerous and is contra-indicated especially if the patient is advanced in years. Small doses should be given beginning with one million, followed at intervals of two or three days by others of slightly larger size. The temperature, which is often high and sometimes oscillating, should fall almost immediately after a dose, but it frequently rises again after about forty-eight hours. The second dose should then be injected so as to bring about a similar fall in the temperature. If the doses are too large the temperature will rise instead of decline. (*See* Vaccine Therapy, Vol. III., p. 262.)

HAROLD SPITTA.

CHOLERA.

Asiatic cholera is due to the spirillum of Koch. It may be isolated without difficulty from the rice-water stools of cholera patients. The organism never enters the body.

Active immunisation against the disease by means of a vaccine has been practised by Haffkine and others with success since 1894. The method involves the use of two vaccines, one attenuated and comparatively non-virulent, the other of artificially exalted virulence. The injections are given hypodermically in the flank, the patient remaining in bed after each dose until the temperature is normal. The injection is followed by pain, swelling and some pyrexia. The more virulent vaccine is administered seven days after the attenuated vaccine has been given. This does not as a rule produce much constitutional disturbance.

There is no doubt that by the use of this method of treatment the cholera mortality in inoculated patients is much decreased. It is uncertain how long the active immunity persists, possibly for a period of six months or perhaps a year.

Individuals under inoculation should be careful not to mix with cholera patients or live in an infected area for a period of fourteen days after the first inoculation, as during this period of time the susceptibility to acquire the disease is considerably increased.

The use of a specific cholera serum has not been attended with success in men. (*See* special article on Cholera, Vol. III.)

HAROLD SPITTA.

DIPHTHERIA.

Serum therapy plays a very important part in the treatment of this disease. It is fortunate for man that the causative agent of this serious infection, the Bacillus Diphtheriæ of Klebs-Loeffler, yields on artificial culture media a soluble toxin, and that the horse is able to manufacture enormous quantities of anti-toxin in response to inoculations with the diphtheria toxin. It is not, however, a generally recognised fact that all cultures of the B. Diphtheriæ do not yield a soluble toxin when cultivated on artificial media *in vitro*. Few cultures of this organism yield a suitable toxin; in fact, the majority of anti-toxic sera owe their origin to inoculations of the horse with subcultures of one and the same original culture, or certainly of twenty to thirty original cultures if all civilised countries are taken into account. Further, all horses are not able to elaborate the anti-toxins in sufficient quantities:

a poorly bred horse is quite unable to do so, whilst a thorou bred English horse is so susceptible to the poison that it practically impossible to immunise it to any degree. So th for the production of an efficient diphtheria anti-toxin not on has a very special strain of bacillus to be used for the inocu tion of the horses, but this strain must be injected into healt half-bred horses aged between four and nine years. T horses are immunised by hypodermic injections of filtered toxi of cultures of diphtheria bacilli. From time to time the seru of the horses is tested as regard its content in anti-bodies, a when this is found to be satisfactory the horse is bled into sterile vessel. When the blood thus drawn off has clotted, t serum is pipetted off and secured in sterile vessels, ½ p cent. or ¼ per cent. carbolic acid being added to prevent co tamination, and a little glycerine to prevent solidification of t serum during the winter months.

Standardisation of the Anti-toxin.—The medical professi is supplied with hermetically sealed phials containing so ma units of anti-toxin, so that reference must be made to the w in which the standardisation is carried out.

Firstly, it is determined by animal experimentation what do of diphtheria toxin, mixed with an anti-toxin unit, causes t death of the animal in four or five days, when injected into guinea-pig weighing 250 grammes. Taking this amount as t test dose, varying amounts of anti-toxin are added to this do until one is found which just prevents the death of the anim Supposing that $\frac{1}{400}$ cubic centimètre of serum is sufficient do this, the serum is said to contain 400 anti-toxin units every cubic centimètre.

After standardisation the serum is placed in hermetica sealed phials, usually of amber colour, and the number of un of anti-toxin contained in each serum is clearly printed on label. Such a serum keeps well if placed in a *dark and c place.* Every batch of sera sent out by any one firm or labo tory should, however, be tested from time to time, as so strains deteriorate more rapidly than others.

Dangers and Ill-effects of the Serum.—The techni employed in the manufacture of anti-toxins is so perfect no days that the dangers of infected samples are practically n existent. The fact, however, that a foreign—that is to s horse—serum is introduced into the human body sometin determines an inconvenient if not serious train of sympto known as serum-disease (Serumkrankheit). This disease characterised by slight elevation of temperature, malaise, headache, nausea, an urticarial rash over the body, and pains or swellings in the joints. Wright has shown that this is mainly due to a decreased coagulability of the blood, followed by serous hæmorrhages. It has been found that the administration of the salts of calcium, notably the chloride or lactate, is able to counteract these ill-effects of the serum, and this method of prophylactic treatment has been followed by satisfactory results. The writer has tested the efficacy of the calcium salts in this direction by administering the lactate of calcium in 15-gr. doses for three days, following the injection of an anti-toxin which had been found to be unusually productive of serum disease. Alternate children received anti-toxin without calcium, the others received anti-toxin and calcium. Every child receiving this particular strain of anti-toxin manifested some degree of serum disease, whilst those which received in addition the salt of calcium were entirely free from this complication. Netter published an instructive series of cases in Paris, which are worth recording:

				Per cent.
Less than 20 cubic centimètres of serum injected.				
Treated with calcium	105 cases, of which	1 case had serum disease	=	0·95
Untreated „ „	118 „ „ „	14 cases „ „ „	=	11
20 to 40 cubic centimètres of serum injected.				
Treated with calcium	117 cases, of which	2 cases had serum disease	=	1·7
Untreated „ „	117 „ „ „	22 „ „ „ „	=	20
More than 40 cubic centimètres injected.				
Treated with calcium	23 cases, of which	3 cases had serum disease	=	13
Untreated „ „	20 „ „ „	5 „ „ „ „	=	25

Dosage of the Diphtheria Anti-toxin.—Although this remedy has been in the hands of the profession so long a time, there does not seem to be unanimity of opinion as to the exact dosage to be employed. The general tendency is to give larger doses than was formerly the case.

The following seem to be the doses most usually advocated:

Class of Case.	Initial Dose.
Slight	1,000 units
Moderate	3,000 to 4,000 units
Severe	10,000 to 50,000 units

The dose should be repeated daily until the desired cure is effected.

The usual method of administration is by hypodermic injection into the subcutaneous tissues of the abdomen or back.

In grave cases the fact that the anti-toxin is but slowly absorb by the tissues has prompted some clinicians to resort to direct int venous injection. It has been shown by Henderson-Smith a Madsen that it takes three days before the blood of a healthy indi dual has absorbed the maximum amount of anti-bodies, and it is fair presumption that with a debilitated circulation the patie suffering from diphtheria absorbs the serum less rapidly.

It has been shown that the diphtheria anti-toxin injec intravenously is five hundred times as powerful as when it is giv subcutaneously. Theoretically, then, when dealing with very sev cases the ideal method should be to administer larger doses serum into the veins. The question of anaphylaxis and attending dangers contra-indicated the procedure; but the la studies of Besredka, who has shown that anaphylaxis can satisfactorily dealt with, removes this objection to the intraven method. Besredka has shown that there is no danger in repea injections of serum directly into the blood stream if very sm doses of a similar serum are given hypodermically or, dilu with equal volumes of salt solution, by the rectum on the d preceding the repetition of the serum injection. As yet it impossible to say in how far this method may prove to be of in the saving of grave cases of diphtheria.

The Therapeutic Value of the Anti-toxin.—A host of statist are available which incontestably prove the value of the an toxin in the treatment of diphtheria. The following oft-quo table of Dieudonné's may be taken as an example:

Author.	Number of Cases.	Mortality per cent.	1st day.	2nd day.	3rd day.	4th day.	5th day.	6th day.	After 6th day.	U kn
Welch . . .	1,489	14·2	2·3	8·1	13·5	19·0	29·3	34·1	33·7	17
Hilbert . . .	2,428	18·3	2·2	7·6	17·1	23·8	33·9	34·1	38·2	–
Collective Investigation of the American Pædriatic Society .	5,794	12·3	4·9	7·4	8·8	20·7	35·3	—	—	–
Collective Investigation of the Austrian Board of Health .	1,103	12·6	8·0	6·6	9·8	25·5	28·8	30·7	21·0	31
Collective Investigation of "Des Kais Gesundheitsamtes" (Germany) . .	9,581	15·5	6·6	8·3	12·9	19·0	23·2	—	26·9	–

Fibiger's statistics are especially valuable, inasmuch as th deal with cases treated during one year, so that the figures are strictly comparable. The method adopted was to treat the diphtheria patients admitted to hospital on alternate days with serum, whilst those admitted on the intervening days received none:

204 cases without croup, treated with serum . . . . . . 5 died
201 „ „ „ „ without serum . . . . . . 14 „
35 „ with „ „ with serum . . . . . . 3 „
43 „ „ „ „ without serum . . . . . . 15 „

It comes out clearly from the published statistics that it is of the utmost importance to inject the serum as early as possible in the disease.

Three tables of statistics are worthy of note in this connection:

(1) METROPOLITAN ASYLUMS BOARD REPORTS, 1902.
Cases Treated at the Brook Fever Hospital.

Day of the Disease on which Treatment Commenced.	Mortality per cent.					
	1897.	1898.	1899.	1900.	1901.	1902.
First . . .	·0	·0	·0	·0	·0	·0
Second . . .	5·4	5·0	3·8	3·6	4·1	4·6
Third . . .	11·5	14·3	12·2	6·7	11·9	10·5
Fourth . . .	19·0	18·1	20·0	14·9	12·4	19·8
Fifth . . .	21·0	22·5	20·4	21·2	16·6	19·4

(2) FABER.

Day of Disease.	Treated.	Cured.	Died.	Cure per cent.
First . . .	99	92	7	92·9
Second . . .	641	593	48	92·5
Third . . .	763	694	69	91·0
Fourth . . .	555	492	63	88·6
Fifth . . .	334	282	52	84·4
Sixth . . .	171	142	29	83·0
Seventh . . .	80	63	17	78·7
Later than Seventh day . . .	196	157	39	80·1
Unknown . .	298	263	35	--
Together . .	3,137	2,778	359	88·6

(3) Kossel.

Day of Disease.	Treated.	Cured.	Died.	Cured per cent.
First . . .	7	7	0	100
Second . . .	71	69	2	97
Third . . .	30	26	4	87
Fourth . . .	39	30	9	77
Fifth . . .	25	15	10	60
Sixth . . .	17	9	8	47
Seventh to Fourteenth . .	41	21	20	51
Unknown . .	3	2	1	—
Together . .	233	179	54	77

Effect on the Complications of the Disease.—The antitoxin treatment has undoubtedly a great effect on the croup incidence in the disease, as this complication is hardly ever seen when treatment is commenced early. But it is a regrettable fact that the serum has no power to prevent the fever, albuminuria or paralysis which sometimes follow this infection unless it is given in the earliest stages of the disease.

Limitations of the Serum.—Recent bacteriological investigation has shown that clinical cure does not necessarily mean disappearance of diphtheria bacilli from the throat. Just as "typhoid-carriers" are now recognised, so it is found that many patients who have clinically made a satisfactory recovery have not lost the bacilli from their throats, and are thus a source of contagion to those who come into contact with them.

The following figures are suggestive :

Investigation of Cases Convalescent from Diphtheria.

Gregorieff . . .	3 weeks	after	apparent	cure	10	per cent.	had	bacilli
Welch (427 cases) .	,,	,,	,,	,,	13	,,	,,	,,
,, ,, . .	37 days	,,	,,	,,	1	,,	,,	,,
Prip (309 cases)	10 to 20	,,	,,	,,	30·1	,,	,,	,,
,, ,,	90 to 120	,,	,,	,,	0·65	,,	,,	,,

An analysis of all available statistics on this subject may be tabulated as follows :

During the	1st	month of	convalescence	14	per cent.	retain	bacilli
,, ,,	2nd	,, ,,	,,	7·5	,,	,,	,,
,, ,,	3rd	,, ,,	,,	4·0	,,	,,	,,

It has been found that the bacilli may frequently persist as long as ten months after the attack, whilst the longest case on record is four years (Prip).

Considerable attention has recently been devoted to the best means of getting rid of these bacilli, which must constitute an effective means of spreading the disease, if not an actual source of danger to the patient who harbours them.

Antiseptics applied in the form of sprays, gargles or pastilles have met with little or no success. Emmerich suggested the local treatment with cultures of the Bacillus pyocyaneus, which, however, has been attended with variable results.

The most rational and successful method of treatment consists of two procedures: one is active immunisation with dead cultures of diphtheria bacilli (vaccine); the other the local application of a dried anti-microbic serum as advocated by Martin. The two methods combined would seem to yield the surest and most rapid result. It remains to be noted that a certain number of people, more especially those who have been in actual contact with declared cases of diphtheria, may harbour virulent diphtheria bacilli in their throats without actually developing diphtheria. From a point of view of prevention, which is better than cure, these individuals should receive treatment along the lines indicated above. It is worthy of note that a culture should always be made from the nose as well as from the throat in all cases under investigation as "diphtheria-carriers."

The Value of Diphtheria Anti-toxin in Prophylaxis.—It is now recognised that a timely injection of anti-toxin may protect against an infection with the diphtheria bacillus. The duration of the immunity thus conferred is, however, short, probably not longer than fourteen days. When there is an outbreak of diphtheria in any family or community it is therefore advisable to inject those who have come into contact with the disease with anti-toxin. A suitable dose for such purpose is 1,000 to 2,000 units. (*See also* Diphtheria, Vol. I.)

A. C. INMAN.

DYSENTERY.

Shiga in Japan was the first observer to attempt the treatment of bacillary dysentery with a bactericidal serum.

Serum Treatment.—Inoculating horses with his own dysentery bacillus he found that the serum soon acquired definite immunising properties, and suggested its use as a curative agent in man. Elaborating on these researches Todd in England attempted to produce a serum which was both anti-toxic as well as bactericidal in its action. Vaillard in Paris and Rosenthal in Germany, working on the same lines, have produced similar sera and recorded good results. The work of Kraus and Doerr has shown that as far as the

Shiga-Kruse type of bacillus is concerned an antitoxic serum of high potency can be produced with which much better results have been obtained, the mortality sinking from 10—50 °/₀ to 2—5 °/₀. It is noticeable that the most distressing symptoms of the malady, tenesmus and diarrhœa are rapidly relieved by the injection of antitoxin.

Vaccine Treatment.—Forster in India describes cases of bacillary dysentery treated with success by means of a bacterial vaccine. Shiga's bacillus killed by heat was employed. Stock vaccines were utilised until the patient's own vaccine was ready. Doses repeated at ten-day intervals were found most satisfactory. Dysentery vaccine is a toxic substance and its effect must be carefully watched; too large or too frequently repeated doses may lead to marked prostration with diarrhœa and other severe constitutional symptoms. The vaccine is not standardised in the usual manner. The initial dose is 0·1 c.c. It is not often necessary to administer more than four doses. (*See also* articles on Acute and Chronic Dysentery, Vol. III.)

HAROLD SPITTA.

GONOCOCCUS INFECTIONS.

The treatment of both acute and chronic gonorrhœa may be undertaken with a **vaccine** prepared from the patient's own organism. If this is not possible, a polyvalent stock laboratory vaccine must be employed in its place.

Gonococcus vaccine should be administered subcutaneously. Under certain conditions it may also be given by the mouth with success. It is an exceedingly toxic product, and its use requires care and caution. Individuals vary considerably in the manner in which they tolerate its use; in some, doses of one million will produce constitutional effects, in others, considerably greater doses may be given with impunity. After each dose a fall in the opsonic content of the blood occurs which persists as a rule for about forty-eight hours. This phase is invariably followed by one of increased secretion of "opsonin" lasting for a further two to four days. It is rarely necessary to administer larger doses than ten million at any time.

Acute Gonorrhœa.—The patient must rest in bed. Small doses beginning with a subcutaneous injection of a quarter of a million, or half a million by the mouth, allowing an interval of about five days between the progressive doses, will prove most satisfactory. These doses may be gradually increased to four, five, or seven million, at the same time allowing seven to ten days to elapse between each dose.

Administered in this manner it is advisable to give the usual routine urethral injections, employing simple non-irritating lotions. The discharge soon completely disappears, but may return if the doses are too large, or the urethral injections too strong. If the movements of the opsonic index are recorded, it will be observed that the cases treated as above indicated in which the index keeps steady between 1·1 and 1·3, are those which progress most rapidly, and that this condition is only secured by giving the vaccine in small and fairly frequent doses.

Chronic Gonorrhœa.—Rest in bed is essential. As a rule it is very difficult to isolate the gonoccoccus from chronic cases—especially when some of the pyogenic cocci are present as a secondary infection. Many patients do well with the stock polyvalent vaccine in default of one prepared from their own micro-organism. Treatment should be carried out by subcutaneous injection of small and frequent doses, beginning with one million and rising to ten, as occasion requires.

If staphylococci or other pyogenic organisms are present as secondary infections, a vaccine should be prepared and administered in the manner indicated. These organisms are very commonly found, especially in cases of long standing.

In **Orchitis** and **Iritis** small doses of half to two million are recommended. Usually the pain is quickly ameliorated.

In **Gonorrhœal arthritis** the use of a polyvalent vaccine is of great service. Before, however, embarking on a course of treatment, it is well to make sure that the lesion is due to a definite infection with the gonococcus. This information is readily obtained by a differential estimation of the patient's opsonic index to the gonococcus before and after massage. If the condition is not gonorrhœal then the two indices are practically identical. If, however, the arthritis is due to infection with the gonococcus, then a marked difference between the two indices is obtained. The first specimen of blood should be collected after the patient has had a complete twenty-four hours' rest in bed; whilst the second specimen should be taken after one hour's vigorous massage of the joint or other affected part. No matter whether the vaccine is administered subcutaneously or orally, it should be given in small and repeated doses, beginning with quarter to half a million, and increasing gradually to a maximum of five to ten million. Large doses are unnecessary, and instead of hastening the progress of the case, materially retard the cure. (*See* Vaccine Therapy, Vol. III., p. 262.)

HAROLD SPITTA.

MENINGOCOCCUS INFECTION.

The causative bacterial agent of this disease is the Meningococcus intracellularis of Weichselbaum. It can be found in stained films made with the cerebo-spinal fluid, and can also be cultivated from the same source on nutrient glucose agar.

Flexner's Anti-meningitis Serum.—This is obtained by the active immunisation of horses with alternating hypodermic inoculations of (1) dead (or living) cultures of the Meningococcus; (2) extracts of cultures of the Meningococcus.

The serum thus obtained is anti-bacterial and partially anti-toxic (Flexner).

The serum is to be injected into the subdural space. So as not to increase the intradural pressure, it is advisable to draw off the cerebo-spinal fluid first and to replace this with the serum. In adults and in chronic cases where adhesions have formed between the two layers of the dura, so that it is impossible to withdraw the spinal fluid, intra-cranial injection should be resorted to. As is the case with most anti-sera, the earlier in the disease the injection is given the better will be the result. For this reason an intradural injection should be given as soon as the presence of meningitis is suspected, and without waiting for the result of the microscopic and bacteriological examination of the spinal fluid. Indeed, the fluid removed to make room for the serum may be used for these examinations.

The serum should be kept on ice in a dark place, and immediately before use should be raised to the body temperature (37° C.).

The minimum *dose* to be injected at one time is 15 to 45 cubic centimètres, at intervals of three to four days. In grave cases 60 cubic centimètres should be given as an initial dose.

The favourable results of the serum are manifest in a short time. A return to consciousness often occurs within twelve hours, and there is a rapid fall of temperature.

The injections are to be continued as long as the meningococci are still present in film preparations of the spinal fluid. They may be thus found even after the spinal fluid has become sterile to culture.

Clinical Results.—Flexner gauges the results by the effect of the serum (1) on the duration of the disease; (2) on the mortality incidence.

(1) (*a*) In New York during the 1904-1908 epidemic of 350 cases which recovered without serum treatment, the duration of the disease was: One week or less in 3 per cent. of cases; five weeks or

more in 50 per cent. of cases. Of 228 cases treated with serum the average duration of the disease was eleven days. (*b*) Before the serum treatment was instituted practically in no case did the disease end by a crisis; whereas in serum-treated cases (273) cases 25 per cent. terminated by crisis.

	Number of Cases Treated with Flexner's Serum.	Cured.	Died.	Mortality per cent.
(2) (*a*)	712	488	224	31·4

(*b*) The following table, compiled by Flexner, is instructive:

Author.		No. of Cases treated with Serum.	Per cent. Mortality.	Per cent. Mortality of Cases not Treated with Serum.
Flexner Serum	Dunn	40	22·5	70
	Chase and Hunt .	12	25	90
	Sladen	23	13	64
	Fulton	22	31	78
	Koplik	15	13·3	60
	Ladd	31	35·5	?
	Morgan and Wilkinson	10	30	?
	Robb	90	30	75
	Ker	30	43	80
	Netter	50	18	83
Kolle-Wassermann Serum	Krohne	59	40·6	66
	Levy	23	21·7	78
	Többen	29	34	56
Jochmann's Serum	Schoene	30	27	53

(*See also* Purulent Meningitis, Vol. I.)

A. C. INMAN.

MICROCOCCUS CATARRHALIS INFECTIONS.

This micro-organism has been shown to be the cause of catarrhal affections of the respiratory tract, upper and lower. Usually it is found in association with other bacteria, *e.g.*, pneumo-streptococcus or bacillus of Friedländer. The organism may be recovered from the nasal mucus in a "common cold," or from the sputum in bronchitis and as a secondary infection in pulmonary tuberculosis. Treatment with vaccines has yielded good results in certain cases, especially in bronchitis and nasal catarrh. The initial dose should not exceed 1 million cocci: each subsequent dose may usually be increased by 1 million and be given at intervals of five to eight days, the general symptoms and the effect on the temperature being t chief guides. (*See* Vaccine Therapy, Vol. III., p. 262).

A. C. INMAN.

PLAGUE.

This disease is due to infection by the Bacillus pestis (Yersin ar Kitasato). It occurs primarily in the rat (Mus Rattus), and transmitted to man by a flea which lives on the rat (P. Cheopis Its presence can be diagnosed by bacteriological examination the blood (10 cubic centimètres removed by venepuncture ar inoculated on to broth) or by direct culture from a suspicious bub

Preventive Prophylactic Inoculation.—Active immunisatio with Haffkine's prophylactic (vaccine of the Bacillus pestis) has bee shown to confer a considerable degree of immunity against tl disease.

The prophylactic consists of six-weeks-old broth cultures· whic have been killed at a temperature of 55° C. for fifteen minutes ½ per cent. carbolic is added for preserving.

The following *dosage* is recommended by the Bombay Bacteric logical Laboratory:

To individuals of 10 days to 1 year give 0·2 cubic centimètres or $\frac{1}{25}$th of full dos
" 1 year " 2 years " 0·8 " " " $\frac{1}{5}$th "
" 2 years " 5 " " 1·6 " " " $\frac{2}{5}$th "
" 6 " " 11 " " 2·4 " " " $\frac{3}{5}$th "
" 12 " " 15 " " 3·2 " " " $\frac{4}{5}$th "
" 16 " " 50 " " 4·0 " " " full dose
If the dose marked on the bottle is 4 cubic centimètres (1 c.c. = 18 minims).

Persons over fifty years of age should be given $\frac{1}{10}$th less for eac decade over that period.

Women of all ages over fourteen years should be given $\frac{1}{10}$th les than men of corresponding ages.

Pregnant women should be inoculated up to the seventh mont without reduction of dose. After the seventh month the dos should be given in two instalments, separated by an interval of week or so.

It is important to remember that if these doses are employe there is no danger in using the prophylactic during an epidemic.

Re-inoculation.—One inoculation has been shown to last well fo two years, and even after five years some protection exists, but it i advisable to be reinoculated every plague season when in contac with the disease.

Results.—The following table has been compiled by Majo Wilkinson, I.M.S.:

	Population.	Attacks.	Deaths.	Case Incidence.	Case Mortalit
Inoculated	186,797	3,399	814	1·8	23·9
Not Inoculated	639,630	49,433	29,723	7·7	60·1

Anti-plague Serum.—Various preparations have been tried in the treatment of plague, but so far without any very marked benefit. From the following table compiled by Dieudonné it would seem that the only effect is slightly to prolong the life of the patient:

—	Treated with Serum.				Treated without Serum.				Average Days over the Normal Duration of Disease in Cases Treated with Serum.
	No.	Deaths.	Cures.	Deaths per cent.	No.	Deaths.	Cures.	Deaths per cent.	
Yersin's Serum	226	168	58	74·33	231	163	68	70·56	3·38
Lustig's Serum	608	436	172	71·71	609	482	127	79·14	1·13
Terni's Serum .	110	89	21	80·90	110	90	20	81·81	0·34
Brasilian Serum	70	58	12	82·85	70	60	10	85·71	0·31

(*See also* article on Plague, Vol. III.)

A. C. INMAN.

PNEUMOCOCCUS INFECTIONS.

The pneumococcus in common with the streptococcus is responsible for inflammatory infections of nearly every organ in the human body. Further, it is now well established that the pneumococcus is a normal inhabitant of the upper air passages in man, although the virulence of the strains recovered under such circumstances is rarely so great as when the organism is recovered from a focus of disease. This same bacterium may be responsible for such grave diseases as pneumonia, pleurisy, otitis media, peritonitis, meningitis, endocarditis, bronchitis, etc. Before assuming the pneumococcus to be the causative agent of any disease, it is necessary to establish first an accurate bacteriological diagnosis. It has been estimated that 10 per cent. of cases with clinical signs of acute lobar pneumonia are due to infection by bacteria other than the pneumococcus.

The results of treatment of pneumococcus infections by an **anti-pneumococcus serum** have yielded disappointing and inconclusive results. The administration of **bacterial vaccines**, on the other hand, has yielded results sufficiently encouraging to indicate a further and extended trial of their merits. In acute lobar pneumonia it is especially in elderly and debilitated subjects that the vaccine treatment has proved of use. Parry Morgan has reported on forty-three cases which by reason of their severity were treated by vaccines, with only one death.

The *dose* of pneumococcus **vaccine** usually recommended in t treatment of pneumonia is 10 to 20 millions of a stock vaccin but further experience shows that better results are obtained b giving an initial dose of only ½ to 1 million bacteria. Th usual sequence is that after a temporary reduction of the fever subsequent rise of the temperature follows; the dose may then b increased to 3 or 5 millions. It is impossible to lay down an absolute rules, as the result of each inoculation varies with th individual capacity for response.

In the more chronic infections due to the pneumococcus, disease of the upper respiratory and intestinal tracts, the initial dose shoul not exceed 5 million bacteria; as long as no febrile reaction i produced the dose can be increased gradually at eight to ten-da intervals to 30 or even 60 millions. In the chronic infections a autogenous vaccine should always be employed. Satisfactor results have attended the use of autogenous vaccines in th treatment of pneumococcus infections of the eyes (corneal ulce ulcus serpens, etc.).

Collection of Material.—In cases of pneumonia, should a autogenous vaccine be required, the method advocated by Morga and Willcox of puncturing the consolidated lung with a fin hypodermic needle may be recommended. In ulcerative endo carditis cultures are obtained from the blood removed by vene puncture. When infected secretions or excretions (sputum, pus fæces, urethral discharges, etc.), are available for direct cultivation it is important that the material should be as fresh as possible collected free from all antiseptics and placed in a sterile vesse which can be securely closed without subjection to great heat. (*Se also* Vaccine Therapy, Vol. III., p. 262.)

A. C. INMAN.

POLLANTIN (DUNBAR'S ANTITOXIC SERUM).

Dunbar has shown that the pollen of certain plants is a cause o hay fever in predisposed patients. In this country the poison i contained mostly in the pollen of the Graminaceæ, and can b extracted with saline fluid and precipitated by alcohol. In this wa a highly toxic albumin is obtained. The antitoxin is prepared b subjecting horses for about three months to a series of subcutaneou injections of increasing doses of this toxin.

As soon as the serum has reached a high antitoxic standard portions of blood are withdrawn, eight days being allowed to elaps after the last injection, so as to make quite certain that n undestroyed pollen toxin remains in the blood. The serum obtaine in this way is known as "Pollantin," and is supplied either in a liquid or solid form for external application only. Subcutaneous injection is not recommended. The solid Pollantin is identical with the liquid variety, as it only represents the serum dried *in vacuo* and ground to a fine powder with sterile milk sugar.

Speaking broadly, the fluid serum is best adapted for ophthalmic use, while the powdered form is most suitable for nasal treatment. If **liquid pollantin** is employed (1) *for the eye*, a small quantity of the phial contents is removed with a pipette and one drop allowed to fall into the outer corner of the lower eyelid, which is drawn away to receive the drop. This process should be repeated every morning before rising, great care being taken to sterilise the pipette by boiling for two minutes on each occasion before use. (2) *For the nose*, the pipette charged with the Pollantin as before, two drops are allowed to fall into each nostril while the head is held slightly backwards.

If **powdered pollantin** is employed (1) *for the eye*, a new camel's hair brush charged with a little of the powder should be used to touch the inner surface of the lower eyelid previously drawn away from the eye. A fresh brush should always be employed on each occasion. (2) *For the nose*, a small quantity of the powder placed in the small scoop provided is held under the nostril while the other is closed. The powder is sniffed up and diffused into the nose by repeatedly tapping the side of the nostril while the sniffing action is in progress.

Statistics show that this antitoxin method of treatment is attended with very favourable results, complete cure being effected in about 60 per cent. of all cases treated, while no less than 25 per cent. of the remainder derive material benefit. (*See also* article on Hay Fever, Vol. III.)

HAROLD SPITTA.

PYORRHŒA ALVEOLARIS (RIGG'S DISEASE).

This condition in its early stages is often amenable to vaccine treatment. The disease is almost always associated with the presence of a short form of the streptococcus pyogenes either present in a pure state or mixed with the staphylococcus aureus or with the micrococcus catarrhalis. Stock vaccines are useless. Patients must be treated with small doses of a **vaccine** prepared from their own organisms, and intervals of five to seven days allowed to elapse between each dose.

Subcutaneous doses of five million streptococci should be given and gradually increased to forty or fifty million. Treatment must be carried on for a period of at least ten to twelve weeks. It is absolutely essential that special attention be paid to the hygiene of the mouth. An antiseptic dentifrice should be recommended and the patient instructed as to the importance of frequently applied mouth washes. Of oral lotions peroxide of hydrogen, administered three times daily at the outset, will prove most satisfactory if made up in a three volume strength. Later on the strength may be increased to five volumes and the lotion used as a mouth-wash not less than five times a day.

Much valueless literature has been published in connection with the vaccine treatment of this condition. (*See also* Vaccine Therapy, Vol. III., p. 262.)

HAROLD SPITTA.

RABIES.

See Volume I.

STAPHYLOCOCCUS INFECTIONS.

The offending micro-organisms in these infections may be the Staphylococcus albus, aureus or citreus. Cultural characteristics will reveal the identity of each variety. A successful method of dealing with these infections is by employing a **vaccine** of Staphylococci. The best results would seem to have been obtained from the use of a vaccine prepared from the patient's own microbe. At all events, cases have satisfactorily yielded to such a procedure which had resisted treatment with stock vaccines. A suitable initial dose of the staphylococcic vaccine is 100 million bacteria, administered hypodermically into healthy tissues. The doses should be given at ten days' intervals, and slowly increased by 100 million at a time until the maximum dose of 800 million or 1,000 million bacteria is reached. The injections should be continued for some time after apparent cure is achieved.

An attempt has been made in many quarters to prepare an anti-**staphylococcus serum.** A satisfactory serum has, however, never been obtained, and all such sera are worthless therapeutically, and may even be toxic, as Bulloch has shown.

Preparations of **yeast** have yielded good results in some hands and recently Deutschmann has prepared a serum obtained from animals which have been fed on enormous quantities of yeast. In this way the active principle can be introduced into the human body in concentrated form.

This serum is prepared by the firm of Ruete-Enoch, in Hamburg. [Tube containing 4 cubic centimètres of *Deutschmann's serum*, m. 2.20 (2*s*. 2*d*.). Tube containing 4 cubic centimètres of the

Deutschmann serum E (double strength), m. 5 (5*s.*)]. The initial dose of the *Deutschmann serum E,* which differs from the original, in that it is purified and concentrated, is for adults 4 cubic centimètres; for children, 2 cubic centimètres.

In adults the dose can be repeated daily and increased until 8 cubic centimètres are given at a time. The injections are to be repeated until the desired effect is obtained.

In children 4 cubic centimètres should be regarded as the maximum dose.

The serum is harmless, and it must be understood that it is neither anti-toxic nor bactericidal, nor is it specific in any sense of the word. It may be used in a great variety of bacterial infections, but has shown itself to be especially valuable in the treatment of staphylococcus infections and infective diseases of the eye (hypopyon-keratitis, iritis). (*See also* Vaccine Therapy, Vol. III., p. 262.)

A. C. INMAN.

STREPTOCOCCUS INFECTIONS.

For cases of local streptococcus infection and for septicæmic conditions associated with the presence of the Streptococcus pyogenes in the blood, streptococcus vaccine may be employed. Although a vaccine from a stock laboratory culture may be used for the initial dose, it is necessary for the patient to be treated at the earliest possible moment with a vaccine prepared from his own specific organism.

Directions for isolating the Streptococcus present.—(1) *If a local infection is present*, it will suffice to send to a competent bacteriologist a small quantity of the pus collected on a sterile swab (previously moistened with sterile water) for the purpose of cultivating the microbe present and for the ultimate preparation of the specific vaccine. (2) *If the case is one of blood infection*, it is then desirable to send to the bacteriologist not less than 5 c.c. of blood collected from the median basilic vein according to the following directions. This is easy to accomplish without fear of contamination if the following suggestions are observed:—

(*a*) Clean the arm of the patient at the bend of the elbow with hot water and soap followed by carbolic acid 1 in 20, absolute alcohol and ether.

(*b*) Prepare a sterile syringe of 10 cc. capacity provided with a new sharp steel needle. Syringe and needle should be sterilised together in a large test tube either in the autoclave at 115° C. for twenty minutes or by boiling for half an hour.

(*c*) Provide two flasks each containing 100 c.c. of sterile nutrient gelatine, which have been stood in warm water for half an hour, until the medium is in a liquid condition.

(*d*) Bandage the outstretched arm tightly well above the elbow.

(*e*) Take syringe out of tube, hold barrel firmly in right hand and insert needle in the largest vein at bend of elbow in the direction of the shoulder joint. Slowly draw up piston, the blood will then flow rapidly into the barrel of the syringe.

(*f*) When full, remove bandage from arm and *then* gently withdraw the needle from the vein. No blood should ooze out of the wound.

(*g*) Paint a little collodion over point of puncture. No bandage or other dressing is required.

(*h*) Squirt half the quantity of blood obtained into one flask and the balance into the other. Mix well.

(*i*) Stand both flasks in cold water until the medium has completely solidified. This ensures safe transit to the laboratory.

(*j*) Convey flasks to bacteriologist who will isolate organism present and prepare vaccine.

The cultivation of the specific organism and the preparation of the vaccine should occupy about three days.

In those cases in which the streptococcus pyogenes has been isolated from the blood, the vaccine is given either subcutaneously or orally in small doses. An initial subcutaneous or oral dose of half a million for an adult and quarter of a million for a child under ten is usually given. The doses are gradually increased every five to seven days at the discretion of the physician to five, seven, eight and ten millions. The period of treatment extends over eight weeks or more.

There are a few cases on record in which definite recovery has taken place after a course of vaccine treatment in cases of verified streptococcal septicæmia.

In secondary infections, in which the streptococcus pyogenes is associated with the tubercle bacillus in sputum, subcutaneously administered vaccine prepared from the patient's own organism will be found most suitable. Doses should rarely exceed three or four millions given at weekly intervals.

Larger doses should be discouraged as they are apt to be attended with severe constitutional disturbances with rise of temperature.

Anti-streptococcus Serum.—Though this is extensively employed its use is rarely attended with marked curative results. The serum is prepared by subjecting horses to gradually increasing doses of various strains of streptococci artificially exalted in virulence first of all subcutaneously and then later on by intravenous injection. In this manner a highly immune serum is obtained which should always be tried in cases of verified streptococcus infection in man. At the present moment, owing to technical difficulties, it is not possible to standardise *accurately* the serum so obtained, but no harm can result from the immediate subcutaneous injection of 20 c.c. into the flank, followed by a similar dose at intervals of twenty-four hours. If, however, the temperature shows no signs of falling after the fourth or fifth dose has been administered, then the particular brand of serum employed should be rejected and another maker's product tried in its place. All anti-streptococcus sera supplied at the present day are of the polyvalent variety (*e.g.*, obtained from horses which have been immunised by the injection of various strains of streptococci obtained from different sources) in contradistinction to a monovalent serum prepared by immunising the horse by injection of only one variety of streptococcus.

It should be clearly understood that although the use of anti-streptococcus serum is recommended and should be tried in all cases of genuine streptococcus infection—yet it is still on its trial, and if no material benefit results from one polyvalent brand, then the use of another polyvalent serum is quite justified. (*See also* Vaccine Therapy, Vol. III., p. 262, and articles on Cellulitis, Erysipelas, Infective Endocarditis, and Septicæmia, Vol. I.; and Pyorrhœa Alveolaris (Rigg's disease), Vol. III., p. 287.)

HAROLD SPITTA.

TUBERCULOSIS.

Tuberculin Therapy.—This is an example of vaccine therapy. One form or other of tuberculin is probably used to a greater extent than any other vaccine. Soon after its first introduction by Koch, it fell rapidly into disfavour, but now it seems likely to come into general use. Varying reports of its value are still received, but it will usually be found that those who have had extensive experience of tuberculin are confident of its value, whilst those who report against it, have very slight actual experience of it in practice or have not mastered the necessary details of its administration. My experience, which has been extensive during the last five years, shows me quite definitely, that in tuberculin we have a most potent remedy for good in a large number of examples of all forms of chronic tuberculosis. In cases of acute tuberculosis naturally we cannot expect such a large proportion of good results, chiefly because in many instances we are dealing with a succession of auto-inoculations which make this form of therapy impossible. With tuberculin, however, I have seen results even in acute and desperate conditions which I have not seen with other methods. With regard to pulmonary tuberculosis, I would say that in the chronic forms, tuberculin not only hastens the process of recovery, but diminishes the tendency to relapse, provided it is given properly and for a sufficiently long period of time. Perhaps the best proof that experience shows the value of tuberculin, is the fact, that in 1905, tuberculin was used at only thirty-six out of 123 private and public Sanatoria, but in 1907 this remedy was used at seventy-seven institutions out of 135. Unfortunately tuberculin is a potent remedy, and often does much harm in incompetent hands. Those who give it should therefore make themselves familiar with the way in which its administration and the spacing of doses are controlled, instead of being guided, as so many are at present, by preconceived ideas founded on the results obtained by the administration of ordinary pharmaceutical remedies.

A considerable number of tuberculin preparations are on the market. Of these only the Bacillary Emulsion (B.E.) is a complete vaccine. It is much cheaper than the new Tuberculin (T.R.), which is so generally used in this country, and apparently gives as good results, except that it causes febrile reactions more readily. It is the favourite preparation in Germany and is being much more freely used by English practitioners than formerly, In some instances B.E. leads to painful infiltrations at the seat of injection. In these instances, and in cases in which there is a tendency to reaction after the administration of B.E., the Sensibilised Tuberculin Bacillary Emulsion is the preferable preparation. According to Carl Spengler and others, human and bovine tuberculosis may be compared in some respects to smallpox and cow-pox, and consequently it is held that bovine tuberculin should be used in tuberculosis of human origin such as pulmonary tuberculosis, and human tuberculin in tuberculosis of supposed bovine origin such as glandular or joint infection. There is little evidence to support this theory, but bovine preparations are less likely to cause reactions, and may therefore be used in sensitive cases. A certain number of cases are on record in which tuberculin has been prepared from the patient's own strain. This practice is on the increase, but it is doubtful whether better results are obtained by it.

I am indebted to Dr. A. C. Inman for the following account of the chief preparations of tuberculin :—

Koch's Old Tuberculin.—Four to six-weeks-old cultures of human tubercle bacilli in 5 per cent. glycerine-broth are evaporated down to one-tenth of their original bulk and then filtered.

It consists of exotoxins and a certain amount of endotoxins.

Koch's New Tuberculin, T.R.—Dried cultures of human tubercle bacilli thoroughly broken up by a pestle in an agate mortar. The powder is then suspended in 0·85 per cent. NaCl-solution and centrifuged. The supernatant fluid is decanted and the precipitate suspended in salt solution to which 20 per cent. glycerine has been added.

1 cubic centimètre of New Tuberculin T.R. = 2 milligrammes of extract from 10 milligrammes of bacilli.

Koch's New Tuberculin, B.E.—Dried cultures of human tubercle bacilli are thoroughly broken up in metal cylinders. The powder is weighed and suspended in physiological salt solution to which 50 per cent. glycerine has been added.

1 cubic centimètre of New Tuberculin B.E. = 5 milligrammes.

Denys's Tuberculin Bouillon Filtré.—Four to five-weeks-old cultures of tubercle bacilli in 5 per cent. glycerine-broth are filtered through a porcelain filter.

This preparation is similar to Koch's old tuberculin, except that it is not evaporated down to one-tenth of its bulk and that it consists of exotoxins only.

The preparation is now on the market, and obtainable from Meister, Lucius and Brüning, Ld., being known as Original Tuberculin T.O.A. Denys calls it the Bouillon Filtré or Tuberculin B.F.

Béraneck's Tuberculin.—Béraneck eliminates from his culture medium substances which may cause febrile reactions *per se*. His tuberculin consists of two parts:

(1) T.B., a filtered, unneutralised and non-peptonised broth-culture evaporated to one-tenth of its original bulk.

(2) A.T., an extract of tubercle bacilli with 1 per cent. orthophosphoric acid.

1 cubic centimètre = 2 milligrammes of dry toxin.

Equal parts of T.B. and A.T. constitute Tuberculin-Béraneck, and it is obtainable from Dr. Béraneck's Laboratory at Neuchâtel.

There are thirteen solutions on the market, $\frac{A}{32}$, $\frac{A}{16}$, $\frac{A}{8}$, $\frac{A}{4}$, $\frac{A}{2}$, A., B., C., D., E., F., G., H., each solution being twice as strong as the last.

Sahli suggests as an initial dose one-tenth cubic centimètre of $\frac{A}{32}$. These observers use the temperature as their guide to treatment. The dose is gradually increased so long as no rise of temperature whatever occurs.

Perlsucht Tuberculin (*Original P.T.*).—This preparation is practically an old tuberculin made with bovine instead of human bacilli.

Perlsucht Tuberculin, P.T.R.—This preparation is practically the same as New Tuberculin T.R., except that it is made from dried cultures of bovine bacilli.

Perlsucht Tuberculin, P.T.O.—This preparation is the same as T.O.A., except that it is made from bovine bacilli.

Sensitised Tuberculin Bacillary Emulsion.—Citron has recently suggested the application of Besredka's methods to the preparation of a "sensibilised" tuberculin. The method relies on the experimental fact that vaccines made from bacteria which have been brought into contact with a homologous immune serum become modified by the immune substances of the serum, and lose to a great extent their liability to cause febrile and constitutional disturbances. Citron has found that such a preparation is suitable for the treatment of patients suffering from pulmonary tuberculosis in an active stage who have shown themselves very susceptible to even small doses of other preparations of tuberculin. By giving such patients a preliminary course of Tuberculin S.B.E., as it is called, he finds that he can gradually immunise the patient so that the usually employed doses of Tuberculin T.R. or B.E. are satisfactorily tolerated.

The original dilution is 1 cubic centimètre = 5 milligrammes.

All the above tuberculins with the exception of Béraneck's can be obtained from Meister, Lucius and Brüning, Ld., 3, Jewry Street, E.C.

Method of Administration.—It is usual to give tuberculin by hypodermic injection. Different sites should be chosen for the successive doses. Good immunising responses are obtained also by the oral method. If for any reason the latter method is preferred the doses should be administered in sterilised salt solution (without the addition of any antiseptic) on an empty stomach, and therefore preferably an hour before breakfast. In some cases a better immunising response appears to result when the doses are given alternately by the mouth and skin. In certain cases of localised tuberculosis, and especially in lupus, it sometimes happens that neither hypodermic nor oral administration of tuberculin produces any satisfactory result. This is due to the fact that the local disease is largely cut off from the lymph supply, and consequently the antibodies which are formed fail to reach the actual seat of disease. In such cases much better results are obtained by injecting tuberculin into the immediate neighbourhood of the diseased area. For this purpose the dose should be divided and injected in four or five different spots.

Dosage.—In all cases and especially in the acuter forms of tuberculosis, it may be laid down that the best results are obtained from tuberculin therapy when care is taken to avoid any considerable febrile reaction as the result of a particular dose. In cases of chronic and afebrile diseases, certain authorities such as Bandelier and Roepke, give increasing doses until a large dose is given or until a febrile reaction is reached. When a reaction is obtained these authorities wait until the temperature has become normal and then repeat the same dose. As a rule a further febrile reaction occurs, but to a less extent. When the temperature has again been normal for a few days the same dose is repeated, and no increase in the size of the dose is made until no reaction occurs. In my experience, it is a wiser practice when a febrile reaction is produced or when other manifestations of a toxic nature occur such as marked headache, lassitude or aggravation of symptoms, *e.g.*, increase of sputum in pulmonary disease, or increase of pain in joint disease, to wait until this has passed off, and then to give a smaller dose on several occasions, before once more trying the effect of the dose which has produced the reaction. Different examples of tuberculosis react differently to tuberculin. In some cases it is possible to proceed rapidly to large doses, in others quite small doses produce a reaction and consequently any increase in dosage must be much more gradual. The increase of dosage permitted may be much more rapid in chronic disease than in acute disease. Again the increase of dosage as a rule may be fairly rapid in cases of chronic pulmonary tuberculosis, and in joint affections without much necrosis, but must be slower in glandular or bladder affections. When much dead tissue is present, and has no outlet, tuberculin will often increase the activity of the diseased process, and apparently hastens abscess formation. In such cases an outlet must be made for the dead tissue, and no further tuberculin should be given until the clinical symptoms show that the activity of the disease has abated. When this has occurred tuberculin therapy should be resumed.

The size of the *final dose* differs in each individual case. In all instances it may be laid down as a rule that tuberculin, if given at all, should be given for at least six months, and that the results are more permanent and relapse less likely if it is given for a year or longer. It is best to aim at such a final dose as 10 milligrammes (1 c.c.) of T.R. or 5 to 10 milligrammes (1 to 2 c.c.) of B.E., but in many instances it is found that a much smaller dose will always cause a reaction and that therefore we are unable to get beyond such a dose as $\frac{1}{100}$ milligramme (·001 c.c.) T.R.

The *initial dose* presents more difficulties. Our object is to avoid a reaction. In acute disease it is therefore best to give a minimal dose such as $\frac{1}{500000}$ milligramme (·0000002 c.c.) T.R. or (·0000004 c.c.) B.E., and then to proceed to give gradually increasing doses at two to three days interval, according to the clinical manifestations, such as $\frac{1}{400000}$; $\frac{1}{300000}$; $\frac{1}{200000}$; $\frac{1}{100000}$; $\frac{1}{80000}$; $\frac{1}{60000}$; $\frac{1}{50000}$ milligramme. If any dose produces fever or an increase of symptoms a lower dose should be given when the reaction is over and persisted with two or three times before trying the higher dose once more. In more chronic cases we may begin with $\frac{1}{50000}$ milligramme (·000002 c.c.) T.R. as a rule. In many instances we can commence without harm with a larger dose, such as $\frac{1}{20000}$ milligramme or $\frac{1}{10000}$ milligramme, but in a few instances $\frac{1}{50000}$ milligramme may cause a marked reaction even in examples of chronic disease. This appears to depend on the ease with which auto-inoculation is produced. We can get some guide to the patient's susceptibility in two ways. If exertion is followed by febrile disturbance, or if a von Pirquet reaction is marked it is best to begin with the smaller doses, but if a patient has no febrile reaction after moderate exertion, or if a von Pirquet reaction is feeble, the initial dose may be larger.

The *increase of dosage* must depend on the effect of each dose. If there are indications of improvement or if no effect is produced the dose may be increased; if the temperature is raised or its daily fluctuations become more marked after a dose, or if there is marked headache, lassitude or an increase in the symptoms, the same dose as before should be repeated at rather longer intervals until no evidence of a reaction occurs. As a general guide the following scheme of dosage may be of service: $\frac{1}{50000}$ milligramme (·000002 c.c.) T.R. or (·000004 c.c.) B.E; $\frac{1}{40000}$; $\frac{1}{30000}$; $\frac{1}{20000}$; $\frac{1}{17500}$; $\frac{1}{15000}$; $\frac{1}{12500}$; $\frac{1}{10000}$; $\frac{1}{8000}$; $\frac{1}{6000}$; $\frac{1}{4000}$; $\frac{1}{2000}$; $\frac{1}{1000}$; $\frac{1}{500}$; $\frac{1}{300}$; $\frac{1}{200}$; $\frac{1}{100}$; $\frac{1}{75}$; $\frac{1}{50}$; $\frac{1}{30}$; $\frac{1}{20}$; $\frac{1}{15}$; $\frac{1}{10}$ at intervals of two to five days according to the acuteness of the disease; then $\frac{1}{7}$ milligramme; $\frac{1}{5}$; $\frac{1}{3}$; $\frac{1}{2}$; [illegible]; 1; $1\frac{1}{5}$; $1\frac{1}{2}$; 2 at intervals of five to ten days.

Certain authorities prefer the use of *bovine tuberculins* in the treatment of human pulmonary tuberculosis. The usual initial dose is ·002 c.c. P.T.O. A dose is given twice a week and gradually increased (·0035 c.c. ·005, etc.) until it reaches 1 c.c., when a change of preparation is made and P.T. is used. In some instances the change to P.T. is made when ·5 c.c. of P.T.O. is the dose reached. The initial dose of P.T. is usually ·01 c.c. Doses are continued twice a week until 1 c.c. of P.T. is given. When this is reached the preparation is again changed and Koch's old tuberculin is administered. The initial dose of this is ·1 c.c., and treatment is continued until 1 c.c. is reached.

The following table, giving the corresponding doses of new tuberculin (T.R.) and bacillary emulsion (B.E.) in milligrammes and cubic centimètres, has been prepared for me by Messrs. Allen and Hanbury, of 7, Vere Street, Cavendish Square:

New Tuberculin T.R.		Bacillary Emulsion B.E.		Tubercle Bacilli.	
1	c.c. or	2	c.c. is equivalent to	10	milligrammes.
0·1	„ „	0·2	„ „	1	„
0·02	„ „	0·04	„ „	1/5	„
0·01	„ „	0·02	„ „	1/10	„
0·005	„ „	0·01	„ „	1/20	„
0·004	„ „	0·008	„ „	1/25	„
0·002	„ „	0·004	„ „	1/50	„
0·0013	„ „	0·0026	„ „	1/75	„
0·001	„ „	0·002	„ „	1/100	„
0·00066	„ „	0·0013	„ „	1/150	„
0·0005	„ „	0·001	„ „	1/200	„
0·0004	„ „	0·0008	„ „	1/250	„
0·0003	„ „	0·0006	„ „	1/300	„
0·00025	„ „	0·0005	„ „	1/400	„
0·0002	„ „	0·0004	„ „	1/500	„
0·000166	„ „	0·00033	„ „	1/600	„
0·00013	„ „	0·00026	„ „	1/750	„
0·000125	„ „	0·00025	„ „	1/800	„
0·0001	„ „	0·0002	„ „	1/1000	„
0·000066	„ „	0·00013	„ „	1/1500	„
0·00005	„ „	0·0001	„ „	1/2000	„
0·00004	„ „	0·00008	„ „	1/2500	„
0·00003	„ „	0·00006	„ „	1/3000	„
0·000025	„ „	0·00005	„ „	1/4000	„
0·00002	„ „	0·00004	„ „	1/5000	„
0·0000166	„ „	0·000033	„ „	1/6000	„
0·0000143	„ „	0·000028	„ „	1/7000	„
0·0000125	„ „	0·000025	„ „	1/8000	„
0·000011	„ „	0·000022	„ „	1/9000	„
0·00001	„ „	0·00002	„ „	1/10000	„
0·0000066	„ „	0·000013	„ „	1/15000	„
0·000005	„ „	0·00001	„ „	1/20000	„
0·000004	„ „	0·000008	„ „	1/25000	„
0·000003	„ „	0·000006	„ „	1/30000	„
0·0000025	„ „	0·000005	„ „	1/40000	„
0·000002	„ „	0·000004	„ „	1/50000	„
0·0000013	„ „	0·0000026	„ „	1/75000	„
0·000001	„ „	0·000002	„ „	1/100000	„
0·0000005	„ „	0·000001	„ „	1/200000	„
0·0000002	„ „	0·0000004	„ „	1/500000	„

Serum Therapy and Other Methods.—The results obtained y means of Marmorek and others with anti-tuberculous sera are not ich as to encourage their wider use. The same criticism may be ade of dioradin and of the intravenous injections of iodoform and her substances.

Secondary Infections.—Recent work shows that organisms uch as pneumococcus, staphylococcus, and micrococcus catarrhalis lay an important part more especially in the chronic forms of ulmonary tuberculosis and in certain cases of so-called surgical tuberculosis. When the presence of these organisms has bee ascertained the use of an autogenous vaccine may afford considerabl relief.

ARTHUR LATHAM.

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TUMOURS (MALIGNANT).

Coley's Fluid.—It has been observed clinically that the accidental supervention of an attack of erysipelas in patients suffering from sarcomatous disease led in some cases to a disappearance of the tumour. Coley conceived the idea of inducing erysipelas in patients suffering from sarcoma. As this procedure is not devoid of difficulties and of actual danger to the patients, he substituted inoculations of toxins derived from cultures of the streptococcus of septicæmia. In its present form Coley's fluid consists of a mixture of two parts: (1) A three-weeks-old broth culture of a streptococcus recovered from a fatal case of septicæmia; (2) a suspension in salt solution of a ten-days-old agar culture of the Bacillus prodigiosus.

The cultures are sterilised by heat (75° C. for two hours) glycerine and thymol are added for preservation.

The mixing is made in certain proportions, and each bottle bears directions for use.

Dosage.—Coley advises as follows:

Initial dose ¼ minim, injected into the buttock or pectoral region

This dose should be increased daily by ¼ minim until the desired effect, *i.e.*, a rise of temperature to 102° to 104° F., is achieved Having ascertained the susceptibility of the patient, the dose must *not* be increased so long as a reaction occurs, and it is advisable to inject this fluid alternately into the buttock and into the tumour The dose injected into the tumour should be less than a fourth of that injected elsewhere. When a certain dose fails to produce a reaction any longer, the dose must be increased by ¼ minim until a further reaction occurs. The highest dose given in many cured cases is 7 or 8 minims. The maximum dose ever given with success seems to be 30 minims.

The treatment must be continued for three or four months afte the tumour has disappeared.

In an experience of 500 cases Coley himself has had only thre deaths from the injections, two of which resulted from embolism.

In July, 1909, Coley reported on his cases of inoperable sarcoma successfully treated by this method. Of these

35 have remained well 3¼ to 16 years.
28 ,, ,, ,, 5 ,, 16 ,,
14 ,, ,, ,, 10 ,, 16 ,,

This method of treatment offers a hope of amelioration or cure in an otherwise almost invariably fatal disease. It is not one to be embarked upon lightly. The most careful watch must be kept on the patient, and the effect of each inoculation thoroughly weighed.

Micrococcus Neoformans.—The micro-organism was first recovered from malignant tumours by Dogen and thought by him to be the cause of cancer. Subsequent investigations indicate that it is a staphylococcus albus which has become slightly modified by its environment. A vaccine prepared from this bacterium has been found to be of use in the treatment of malignant disease by assisting to relieve pain by suppressing the inflammatory changes round the growth. An initial dose of 10 millions is recommended, and this may be cautiously increased to 30 millions. The inoculations should be made hypodermically into healthy tissues, and not into the tumour.

A. C. INMAN.

WHOOPING COUGH.

(*See* Vol. I.)

TETANUS.

(*See* Vol. I.)

TYPHOID FEVER.

This disease is due to the Bacillus typhosus of Eberth, which produces (1) Local ulceration of the bowel with necrosis of the tissues; (2) general intoxication, fever, delirium, etc.

Preventive (Prophylactic) Inoculation.—This consists in inoculating persons who are exposed to infection with a vaccine made from a suspension of typhoid bacilli killed at a temperature of 60° C. for one hour.

Colonel Semple has recently advocated the sterilisation of the vaccine by means of the addition to it of ¼ per cent. carbolic acid, without the intervention of heat.

Dose.—Wright recommends an initial dose of 1,000 million bacteria. After an interval of ten days a second dose of 2,000 million bacteria is to be given.

These two dilutions of the vaccine made in the Laboratory of the Inoculation Department, St. Mary's Hospital, London, are to be obtained from Messrs. Parke, Davis & Co.

After the inoculation there may be moderate or severe constitutional disturbance, malaise, fainting or sickness, so that it is advisable to insist upon rest or even confinement to bed for twenty-four hours after the inoculation. A tender swelling may develop at the site of inoculation, but this does not call for treatment.

The immunity conferred lasts for at least one year. The results of prophylactic inoculation have been satisfactory both as regards reduction of case incidence and mortality. In the Indian Army the incidence of typhoid has been reduced in the inoculated troops by seven-eighths, and the mortality by nine-tenths.

Serum Treatment of Typhoid Fever.—(1) *Chantemesse's Anti-typhoid Serum.*—This is a serum obtained by immunising horses with a liquid filtered culture of typhoid bacilli. The fact that large doses (10 cubic centimètres) can produce marked febrile reactions, and that Chantemesse himself found that effective doses of his serum consisted in injecting 1 or 2 minims only, led Wright (" Studies on Immunisation ") to suggest that the serum contains toxins, and is, indeed, a vaccine in disguise.

Chantemesse gives the following figures to show the efficacy of his serum :

Chantemesse, 712 adults gave a mortality of 3·7 per cent., as against 17 per cent. without serum.
Josias, 200 children gave a mortality of 3·8 per cent., as against 12 per cent. without serum.
Brunon, 100 children gave a mortality of 3·0 per cent., as against 17 per cent. without serum.

(2) *Serum of Rodet and Lagriffoul.*—The first report dealt with some fifty cases treated. The results were satisfactory both as regards fall of temperature and amelioration of symptoms in those patients who received an injection of serum (1 to 8 cubic centimètres) before the eleventh day of disease. After this the serum did not appear to have any marked effect on the progress of the disease.

(3) *Serum of Besredka and Serum of Meyer and Bergell.*—These two sera have only had a short trial, and nothing definite can yet be said as to their efficacy.

Vaccine Treatment of Typhoid Fever.—According to Sir William Leishman, the treatment of typhoid fever with a vaccine of B. typhosus is being tried in India, and has so far led to encouraging results.

It is possible that the preliminary treatment of the bacilli with an immune typhoid serum (sensibilised bacteria) may make the vaccine treatment of typhoid more efficacious. (*See also* Typhoid Fever, Vol. I.)

A. C. INMAN.

SUMMARY OF DOSES USUALLY EMPLOYED IN SERUM THERAPY AND VACCINE THERAPY.

No hard-and-fast statements as to size of the initial dose of vaccine or serum in various infective diseases, or of the subsequent increase of dose, can be given, but the following summary may be of service as showing the average doses employed.

Bacillus Coli Communis.—*Initial dose of vaccine*, (1) In acute infections 1 million; (2) in chronic infections 5 millions. *Subsequent increase of dose*, (1) In acute infections 1½, 2, 3 millions, etc., at intervals of two to three days; (2) in chronic infections 10, 15, 20 millions, etc., at intervals of five to seven days.

Cholera.—*Prophylaxis.*—A dose of attenuated vaccine is given, and in seven days a dose of a vaccine of artificially exalted virulence.

Diphtheria.—*Prophylaxis.*—1,000 units of *antidiphtheritic serum. In treatment.*—A mild case limited to the tonsils, 2,000 units; a case in which the palate, but not the nasal fossæ, is affected, 4,000 units, to be repeated in twenty-four hours; if there is more extensive disease, 6,000 units for an infant, 8,000 units for a child, to be repeated at the end of twelve hours if the first injection is given on the third or fourth day of the disease or of twenty-four hours if the first injection is given on the first or second day. A third or fourth injection of 8,000 units may be required if there is no decided improvement. Adults do not require larger doses. When antitoxin is injected intravenously, 20,000 or more units are usually given.

Dysentery.—*Initial dose of vaccine*, 0·1 c.c. Further doses at intervals.

Gonococcus Infections.—*Initial dose of vaccine*, (1) In acute infections ¼—½ million; (2) in chronic infections, 1 million. *Subsequent increase of dose*, (1) In acute infections, 1, 2, 3 millions, etc., at intervals of seven to ten days; (2) in chronic infections, 2, 3, 4 millions, etc., at intervals of ten days. 20 c.c. of antistreptococcus serum have been given by rectal injection with good results in some cases of chronic gonococcus infections.

Meningococcus Infections.—*Flexner's Serum.*—In ordinary cases, 15—45 c.c.; in severe cases, 60 c.c. should be given as the initial dose. Further doses may be given at intervals of three to four days.

Micrococcus Catarrhalis Infections.—*Initial dose of vaccine*, 1 million. *Subsequent increase of dose*, 1 million at a time at intervals of five to eight days.

Plague.—*Prophylaxis.*—For persons of sixteen to fifty years of age, 4 c.c. of Haffkine's *vaccine*.

Pneumococcus Infections.—*Initial dose of vaccine*, (1) In acute infections, ½—1 million; (2) in chronic infections, 5 millions. *Subsequent increase of dose*, (1) In acute infections, 3, 5, 7 millions, etc., at intervals of twenty-four to forty-eight hours; (2) in chronic infections, 10, 15, 20, 30 millions, etc., at intervals of ten days.

Staphylococcus Infections.—*Initial dose of vaccine*, 100 millions. *Subsequent increase of dose*, a million for each successive injection up to 1,000 millions at ten-day intervals. *Deutschmann's E. serum.*—Initial dose, 4 c.c. Subsequent doses, a dose each day, gradually increased to 8 c.c. and given until the desired effect is obtained.

Streptococcus Infections.—*Initial dose of vaccine*, ½ to 1 million. *Subsequent increase of dose*, a million at a time up to 10 millions in primary infections, and 4 millions in secondary infections at intervals of five to ten days. *Antistreptococcus serum*, 20 c.c. repeated at twenty-four-hour intervals, if necessary, for four to five days.

Tuberculin.—*Initial dose*, (1) In acute infections, $\frac{1}{500000}$ mg. (·0000002 c.c.) T.R., or $\frac{1}{500000}$ mg. (·0000004) B.E.; (2) in chronic infections, $\frac{1}{50000}$ mg. (·000002 c.c.) T.R., or $\frac{1}{50000}$ mg. (·000004) B.E. *Subsequent increase of dose*, (1) in acute infections, $\frac{1}{400000}$ mg., $\frac{1}{300000}$, $\frac{1}{200000}$, etc., T.R. or B.E. at forty-eight hourly intervals if indicated; (2) in chronic infections, $\frac{1}{40000}$ mg., $\frac{1}{30000}$, $\frac{1}{20000}$, etc., T.R. or B.E. of two to three-day intervals if indicated. If bovine preparations are used in chronic cases, it is usual to commence with ·002 P.T.O.; to increase the dose twice weekly until 1 c.c. is given; to change to ·01 of P.T., and increase gradually twice a week until 1 c.c. is given; then to give ·1 c.c. old tuberculin and continue until 1 c.c. of this is given.

Tumours (Malignant).—*Coley's Fluid.*—Initial dose, ¼ min. injected into the buttock daily. Increase dose daily by ¼ min. until there is rise of temperature to 102° F. or more. Continue this dose on alternate days; on intervening days inject one quarter of this dose direct into tumour. When this dose fails to cause reaction increase daily by ¼ min. until further reaction. Continue for four months after tumour has dispersed.

Tetanus.—*Prophylaxis.*—25 c.c. of *antitetanic serum* should b injected into the flank on three occasions at forty-eight hour interval. *In treatment.*—50 c.c. of the antitetanic serum should b injected at once, 100 c.c. twenty-four hours later, and subsequentl further doses of this size if thought advisable.

Typhoid Fever.—*Prophylaxis.*—250—1,000 millions of vaccin should be injected, or 500—2,000 millions after an interval of te days. *In treatment.*—15—30 millions daily.

A. L

RADIUM THERAPY.

The application of radium in therapeutics is made in various ways, of which the two principal are, (1) irradiation, which consists in exposing the organs to rays given out by apparatus containing a radium salt; and (2) induction of radio-activity, which consists in injecting directly into the tissues a radium salt, which through its emanation induces radio-activity, that is to say, the property of giving out the rays characteristic of radium-containing bodies.

METHOD OF IRRADIATION.

The apparatus used is as follows:

(1) Plates made of cloth or metal, to the surface of which sulphate of radium, ground or pulverised, is made to adhere by means of a special varnish, the varnish of Danne (Fig. 1, p. 304).

(2) Tubes of glass, aluminium, silver, gold or platinum, hermetically closed, containing a radium salt in the state of dry powder (Fig. 2, p. 305).

We can divide the apparatus with adherent salt according to its content of radium into:

(a) Of strong activity, containing 1 milligramme to 1 centigramme of pure sulphate of radium per square centimètre.

(b) Of moderate activity, containing from 0·1 to 1 milligramme per centimètre.

(c) Of weak activity, containing less than 0·1 milligramme per centimètre.

As to the quantity of radium contained in the tubes, this varies on an average from 5 milligrammes to 10 centigrammes in actual use.*

The radium salt in these apparatuses is the source of the rays α, β and γ, which differ from one another not only in their nature, but also in their strength, that is to say, in their penetrative power. The α rays are the least penetrative, the γ rays the most penetrative, and between the two there is a series of β rays of more or less penetrative power.

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* The physiological effects of the apparatus vary to a certain extent with the dimensions of the latter, even when they contain an equal quantity of pure radium salt: thus, an application of one hour from an apparatus of 20 centimètres containing 5 centigrammes of radium sulphate—that is, 1 centigramme per 4 centimètres—is more efficient than five applications of one hour from an apparatus of 4 centimètres containing 1 centigramme of radium sulphate.

In theory, the respective proportions of these different rays are as follows:

α	90 per cent.
β	9 ,,
γ	1 ,,

In practice, these proportions are modified owing to the absorption of part or whole of the α and β rays in the varnish or walls of the apparatus.

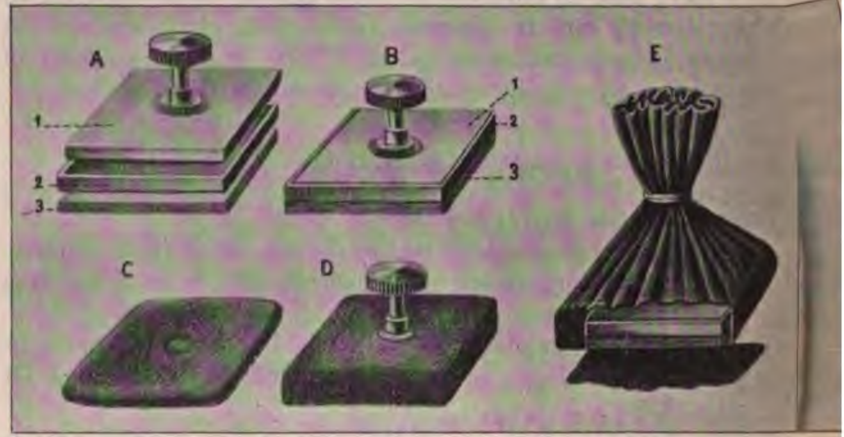

FIG. 1.

A, Radium plate (with a varnish containing radium). 1, superior surface plate (the varnish being on the under surface); 2, metal box acting as a screen to arrest the α rays and the greater part of the β rays; 3, paper screen added to screen 2, in order to arrest the secondary rays.
B, Apparatus A closed up. C, Additional screen.
D, E, Apparatus with rubber coverings.

We can accentuate this absorption by superposing screens made of various substances, which absorb the rays in proportion to their thickness and density. It is in this way that the remnant of the rays that have traversed plates of lead from 5 to 10 millimètres in thickness is reduced practically to the γ rays, and the minimum proportion of the β rays.

By *ultra-penetrant rays* I signify those γ and β rays which are capable of penetrating plates of lead up to 10 millimètres in thickness, and by *infra-penetrant rays* those rays that are stopped by such plates, these rays being the remainder of the β and the whole of the α rays.

have named :

1) The **Composite-ray Apparatus**, that which emits a pencil ays composed of both ultra-penetrant and infra-penetrant; such the radium plates and the radium tubes consisting of glass luminium, the walls of which do not exceed 5 to 10 millimètres.

2) The **Ultra-penetrant Ray Apparatus**, the tubes of silver, d or platinum, the walls of which are from 5 to 10 millimètres hickness, because these walls absorb all the infra-penetrant rays.

s early as 1907 I showed that it was necessary in many cases onvert the composite-ray apparatus into ultra-penetrant ray

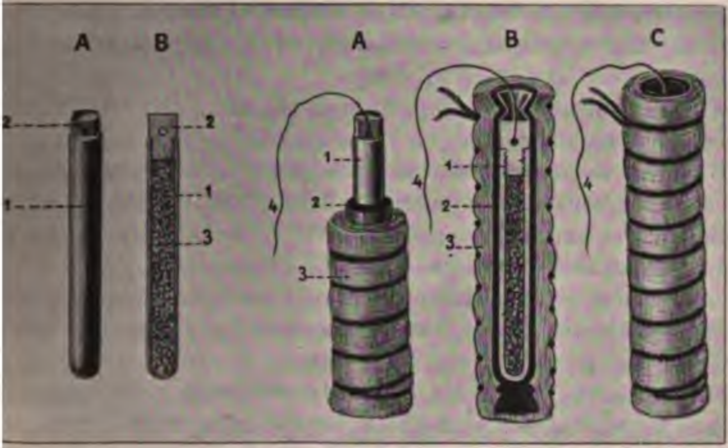

FIG. 2.—Dominici's tubes.

A (left), metal tube containing radium. 1, body of tube ; 2, perforated top.
B „ section of tube A. 1, sheath ; 2, perforated top ; 3, radium salt.
A (right), 1 radium tube ; 2, rubber sheath ; 3, gauze sheet ; 4, silk thread.
B „ section of same.
C „ tube and rubber sheath completely enveloped by gauze sheath.

ratus, for the ultra-penetrant rays have less effect on normal e, while possessing a regressive action on different morbid itions.

use the **Composite-ray Method**, it is sufficient to surround adium plates or tubes with an envelope of rubber, in order to ct them from the fluids of the body.

use the **Ultra-penetrant Ray Method** :

To the radium plates of dense metal, such as lead or silver, m five-tenths to several millimètres in thickness are opposed.*

Vischman in 1905 laid stress on the low penetrative power of the α and great number of the β rays; and advised the suppression of a portion ese rays for the treatment of deeply situated tumours. In prin- all radium-therapists are in agreement with this, and many authors

(2) By surrounding radium tubes with metallic sheaths of silv gold or platinum, in order to allow only ultra-penetrant rays to pa or still more simply by using radium-containing tubes of gold, silv or platinum, which are by definition ultra-penetrant ray tubes.

In cases where an ultra-penetrant ray apparatus is used, it sho be generally surrounded by envelopes of gauze, or of paper, several millimètres in thickness, in order to stop the secondary ra which accompany the ultra-penetrant rays.

These secondary rays do not come from the radium-containi apparatus, but from the metal traversed by the ultra-penetra rays. They are composed of easily absorbed β rays, and con quently are more or less irritating to normal tissues.

From the **topographical** point of view, radium-containi apparatus may be used in two ways:

(1) By application to the surface of the skin, or in the cavities the mucous membranes.

(2) By direct introduction into the pathological tissues.

The apparatus with adherent salt on metal plates, or on clo (which can be suitably shaped), is suitable for application to pla concave or convex cutaneous surfaces.

The apparatus with adherent salt on cylindrical stems is suita for insertion into angles, mucous cavities, and even directly i diseased tissues.

The latter apparatus is generally advantageously replaced radium tubes, the cavity of which, hermetically closed, gives to t radium salt a shelter impermeable to humidity or to orga liquids.

If we have at our disposal several apparatus with adherent s serving for the treatment of the same condition, it will, of course, better to use them simultaneously rather than successively. those places where it is possible to place these apparatus so that t rays cross one another in the depth of the diseased tissue, we ha the process called "Feu croisé" by Wickham and Degrais. Sho we use several radium tubes at once, they should be placed so at the centre and others at the periphery of the diseased part.

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filtered the rays by means of aluminium, or by removing the apparatus fr the surface of the skin or mucous membrane. Nevertheless, it seem indispensable to keep as large a number as possible of the β rays, the γ r appearing to be a negligible quantity. This idea, which seemed at fi sight correct, has been invalidated, both in theory and in practice, by the ult penetrant ray method of Dominici. His researches, made with Rubens-Duv Faure-Beaulieu and Barcat, have shown that radium therapy owes its m important results to the apparatus which furnishes the greatest possi quantity of penetrative γ rays, rendered as homogeneous as possible by mea of screens of maximum density.

Finally, there will be a great advantage in combining the application to the surface of the radium plates, and the introduction into the neoplasm of radium tubes.

From the **physical** point of view radium therapy may be used by two principal methods:

(1) The composite-ray method, where the rays of low penetrative power (α and β) are in excess of those of high power (γ).

(2) The ultra-penetrant ray method eliminates all the α and most of the β rays, and uses essentially the γ rays.

The composite-ray method places at the disposal of the therapeutist a source of energy more important than the ultra-penetrant ray method, and more efficacious if we believe the theory that the curative action of radiation is proportionate to the number of rays absorbed.

In practice, however, the advantage which the presence of the α and β rays gives to the composite-ray method is counterbalanced by the weakness of the penetrative power of these rays, and by their effect on the normal tissues, which diminishes their field of application.

The α and β rays are intercepted by a layer of tissue from 8 to 9 millimètres in thickness (Dominici, Chéron, Bader), above which only the ultra-penetrant rays can pass. Hence the composite-ray method has the disadvantage of causing different physiological results at levels comparatively near one another. Thus in certain cases we may get necrosis of normal tissues, and of pathological tissues in the zone where the α and β rays are stopped, whereas the underlying zones, influenced only by the ultra-penetrant rays, are hardly modified.

This disadvantage is aggravated by the impossibility of compensating the weakness of the rays in the deep tissues by prolonging the time of application, owing to the danger of injury to healthy tissues, which would considerably delay cicatrisation.

The α and β rays, useless for the treatment of deeply situated lesions, are, on the other hand, dangerous with regard to mucous membranes, in which the radium dermatitis (which they are capable of producing) may cause serious functional troubles, and creeping ulcerations may reach zones beyond the action of the rays.

For this reason I have introduced the method of ultra-penetrant rays, which uses almost exclusively the γ rays. These traverse the tissues without being absorbed to any great degree, cause as a rule no great injury, and manifest many curative properties.

To sum up, the composite-ray method is used chiefly in the treatment of superficial cutaneous lesions, and must be applied in séances of short duration. The ultra-penetrant ray method may be used for long periods, is especially regressive in action, and is the better method in the treatment of mucous membranes and of sub-cutaneous and sub-mucous lesions.

Methods of Use.[*]—Radium therapy may be used alone or combined with surgical procedures.

According to the condition, the apparatus is placed on the surface of the skin in the mucous cavities, or plunged into the substance of morbid tissues.

The action is regulated so as to cause cauterisation, followed by regression of the lesions, or regressive action without cauterisation.

APPLICATION OF RADIUM TO THE SURFACE OF THE SKIN OR MUCOUS CAVITIES.

The Caustic Method.—The caustic action of the rays is best obtained by means of radium plates of strong activity, left in action from one to six hours, in two or three séances spread over a week. This treatment necessitates certain precautions as to the diseased portions and the surrounding zones.

With regard to the former, they must be cleaned, crusts removed, and, if necessary, washed with antiseptics; the surrounding zones must be protected by plates of vulcanised lead, in which holes may be cut to expose the lesions, and surrounded with gauze. The apparatus must, of course, be absolutely clean.

The Regressive Method.—For this method composite rays or ultra-penetrant rays may be used.

Composite-ray Process.—Simple regression of the lesions by means of composite rays is obtained by diminishing either the time of application or the intensity of the rays.

In order to avoid sloughing, which might result from the use of too strongly active rays, applications should be of short duration, not exceeding twenty to thirty minutes (radium plates containing 1 centigramme of pure radium sulphate per 4 square centimètres of surface).

As a rule, the applications should be made in series of several séances, lasting from three to five minutes, and repeated every day or on alternate days.

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[*] The following were amongst the first to test experimentally the utility of radium:—Danlos, Zimmern et Nimier, Abbe, Morton, Einhorn, Rehns, Salmon, Branstein Repman, Siehel, Darier, Mackenzie-Davidson, Boikoff, Dieffenback et Lieber, Dudin et Verchère, Foveau de Courmelles, Blaschko, Schiff.

The influence of this treatment may be seen in nervous mani- stations, such as pruritus in its different forms, the plaques of urodermatitis, neuralgia following zona, inter-costal neuralgia, flammatory conditions of the skin or mucous membranes, such as zema, lichen, psoriasis, lupus erythematosus of the conjunctiva, id cavernous erectile nævi.

We can obtain a purely regressive action by comparatively olonged applications of the composite rays by diminishing the tensity of the rays in two ways: first, by using rays essentially

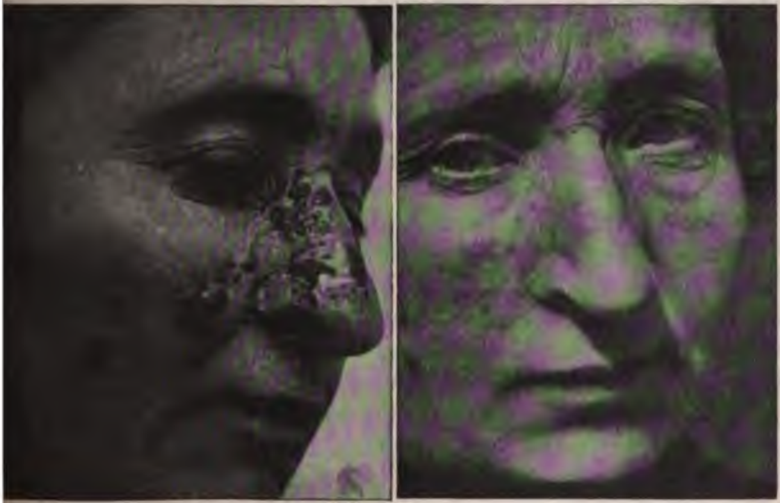

Fig. 3.—Epithelioma of purely embryonic type. This tumour resisted various forms of treatment (scraping, cautery, etc.) for twelve years. Now apparently cured since August, 1908.

eble; secondly, by attenuating, through filtering, the intensity of rong rays.

It is thus that we can, in certain cases, arrest neuralgias, such as hat of the sciatic nerve, the lightning pains or visceral crises of abes, and certain arthralgias, by applying to the affected region loths containing less than 1 milligramme of radium sulphate per 0 square centimètres, the sittings lasting from six to twelve ours.

The same treatment is suitable for exophthalmic goître.

On the other hand, Bayet obtained regression of flat nævi by pplying to their surface for two hours a cloth containing 6 milli- ammes of radium sulphate per 24 square centimètres, and filtering e rays through a thickness of $\frac{5}{10}$ millimètres of aluminium.

These sittings are repeated every other day, so as to reach a total application of twelve hours.

A similar treatment can be used for gonorrhœal arthritis in its sub-acute or chronic forms.

For certain papillomata or superficial cancroids of the skin we use strong rays through $\frac{1}{10}$ millimètre of lead for a period of six to twelve hours.

Attenuation of the rays prevents the formation of sloughs, which might occur from the use of composite rays, either of too great intensity or if applied for too long a period.

This method is an advantage over the ultra-penetrant ray method, in that applications need not be made for so long a period. On the other hand, it is inferior in the treatment of mucous membranes or deeply situated lesions.

The Ultra-penetrant Ray Process.—The relative innocuity of ultra-penetrant rays renders them useful for the treatment of mucous membranes, or of those lesions which, on account of their nature or deep situation, require prolonged irradiations.

The radium plates with rays filtered through screens of lead from $\frac{5}{10}$ to 2 millimètres in thickness are applied to the skin to hasten slow cicatrisations, to soothe inflammatory reactions of traumatic origin, to remove keloids, to cause the regression of inflammatory processes of the skin, such as elephantiasis of streptococcus or staphylococcus origin, tuberculous growths, syphiliomata rebellious to mercurial treatment, and malignant cutaneous tumours, such as lymphadenoma, sarcoma and infiltrating cancroids.

The radium plates covered with lead and the ultra-penetrant ray tubes of silver or gold, carefully covered with gauze, are used in various inflammatory conditions of the mucous membranes, such as leucoplasia of the lips or buccal cavity, rectitis of hæmorrhoidal origin, the discharge of metritis, and hæmorrhage from the uterus.

Of the benign tumours of the mucous membranes which respond to the ultra-penetrant ray treatment, I would especially name papillomata and angiomata.

The action of the ultra-penetrant rays has a favourable effect on malignant tumours of the mucous membranes. For example, lymphadenoma, lymphosarcoma and embryonic sarcoma regress under their influence.

With regard to epitheliomata, these are amenable to the treatment so long as they do not reach beyond the chorion of the mucous membranes. As soon as they infiltrate the subjacent muscular tissue a treatment becomes necessary similar to that required for sub-mucous or sub-cutaneous lesions.

The ultra-penetrant ray treatment then will, as a rule, cure the majority of cases of epithelioma of the labial mucous membrane; but it is insufficient for that of the buccal mucous membrane except in early cases.

Uncertain results have been obtained in cancers of the œsophagus, (with the exception of one favourable result in a case recorded by Finzi) stomach and intestines under the ultra-penetrant ray method; but important results have occurred under this method in some cases of malignant tumours of the rectum, bladder and uterus.

The following lesions which develop in the subcutaneous and submucous tissues respond to the ultra-penetrant ray treatment:

(1) Certain forms of salpingitis (Chéron, Mme. Fabre), bubo of he groin, the adenopathies of filariasis, and those of bacillary denopathies, such as tuberculous lesions of the bone in children.

(2) Angiomatous or lymphangiomatous tumours, uterine fibroids,* ymphadenomata, lympho-sarcomata, sarcomata (with the exception f chondro-sarcomata and certain fibro-sarcomata), some neoplasms f epithelial origin, amongst which are atrophic scirrhus of the reast, and secondary tumours in the axillary or sub-clavicular lands.

INTRODUCTION OF RADIUM TUBES INTO THE TISSUES.

Since the introduction of the ultra-penetrant ray method, it is ossible to irradiate deep lesions through the skin and mucous embranes, without doing injury to the normal tissues.

The apparatus used for transcutaneous irradiation is that of plates ntaining 10 to 20 centigrammes of pure radium sulphate per 0 to 60 square centimètres, covered with a sheath of lead 2 milli- etres in thickness, to which are added cushions of gauze. This pparatus is applied for fifty to sixty hours per week, and may be peated from two to three weeks without injury to the skin.

For transmucous irradiation we use tubes of gold or silver, the alls of which are reinforced by sheaths of silver, from 1 to several illimetres in thickness. These tubes may be used separately r in bundles. The amount of radium in the tubes, their number, e thickness of the walls and the length of application, will vary cording to the organs† or mucous membranes, and according to e resistance of the tissues of the tumour.

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[*] Oudin and Verchère were the first to show the hæmostatic action of radium uterine fibroids.

[†] Dr. Finzi has succeeded in introducing into the œsophagus, without injury it, radium-containing sounds.

Although the results obtained by irradiation of malignant tumours, through the skin and mucous membranes, have been remarkable, it is better to use the process of fixing the radium tubes directly into the tissue of the tumour. For this purpose we use tubes with dense metallic walls, because they are both more resisting and easier to manage than the glass tubes recommended by Abbe and Morton. Though they have an apparent inferiority, in that the rays emitted are of less intensity, this is only apparent, for 5 to 6 millimètres of sarcomatous or epitheliomatous tissue are sufficient to check the power of the rays given out by the composite-ray tubes, so that if the latter have any advantage over the ultra-penetrant ray tubes, it can only be for the treatment of very small tumours.

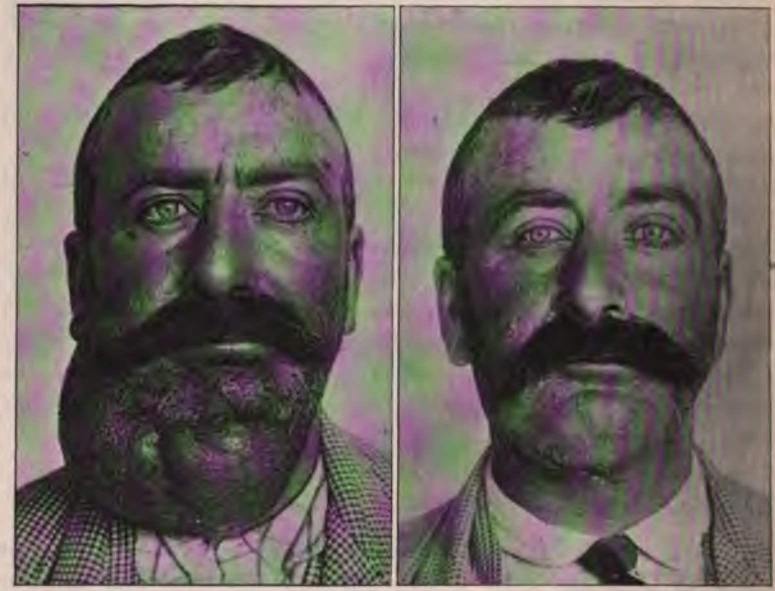

FIG. 4.—Sarcoma, unmixed globocellular type. This tumour was treated from July 28, 1909, by the introduction of two tubes, each containing 5 centigrammes of pure radium sulphate, the rays being filtered through $\frac{5}{10}$ mm. of silver. Treatment resumed November, 1909. Apparently complete regression since January, 1910.

The solidity of the silver, gold or platinum tubes renders them specially serviceable where surgical operations are combined with radium therapy.

RADIUM THERAPY COMBINED WITH SURGICAL OPERATIONS.

The association of radium therapy and surgery, recommended as early as 1908 by Tuffier, and since then by Chevrier, consists of three essentials:

(1) The tumours are removed by surgical operation, which is followed by the introduction into the wound of cylindrical ultra-penetrant ray apparatus, left in position for twenty-four to forty-eight hours.

(2) The tumours are treated by radium therapy, so as to cause a partial regression, facilitating surgical operation, which is then followed by the application of radium, as in the previous method.

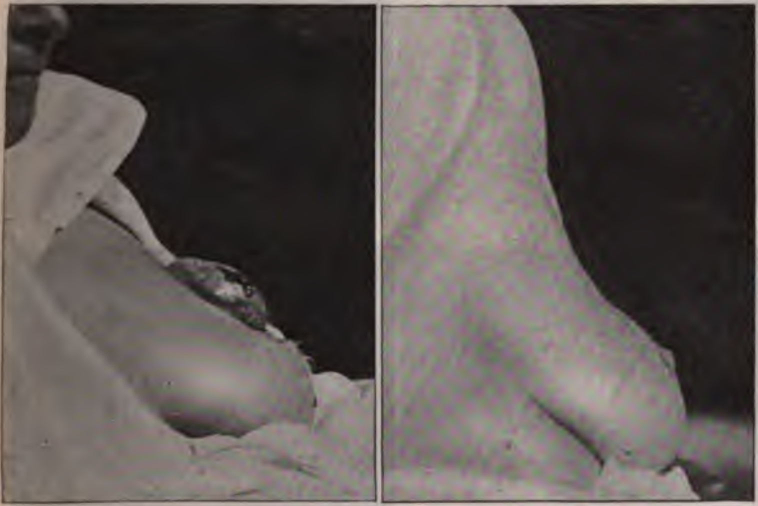

FIG. 5.—Vegetating cancer of breast, apparently completely cured since February, 1910, after the introduction of radium tubes into the neoplasm.

(3) An operation is performed to expose the tumour (*e.g.*, intra-abdominal tumour), the radium tubes being then introduced into the substance of the neoplasm.

The ultra-penetrant ray method is more especially useful for the treatment of cancer of the mucous membranes, and of the sub-cutaneous and submucous zones.

The composite-ray method may be used either alone or combined with surgical operation.

In cases amenable to radium therapy, regression or disappearance is produced of:

Painful conditions, the mechanism being unknown; hæmorrhage due to angiectasis, by diminishing the calibre of the bleeding vessels; inflammation and gangrene, not by killing the pathogenic microbes, but by causing physiological and chemical changes in the tissues, where they multiply; neoplasms, by causing dissolution of the cells, and modifying the evolution of its elements. To these effects is added a very remarkable reparative and cicatrising action.

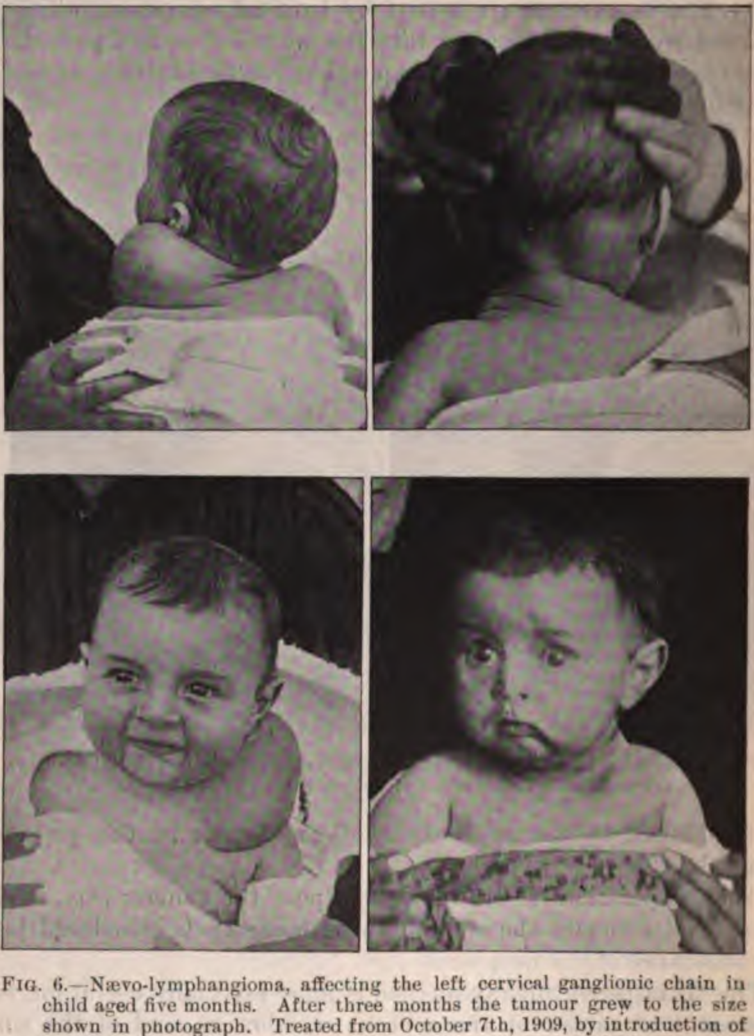

FIG. 6.—Nævo-lymphangioma, affecting the left cervical ganglionic chain in child aged five months. After three months the tumour grew to the size shown in photograph. Treated from October 7th, 1909, by introduction of a silver tube containing 5 centigrammes of radium sulphate for twenty-four hours. Apparent cure since November, 1909.

Recently observations have been made showing that the tumours in such grave conditions as lymphadenoma, sarcoma and epithelioma have regressed under radium treatment, without local recurrence or metastasis, for two or three years.

The most interesting of these observations are those of tumours situated so deeply that they lie beyond the action of the X-rays, which are superior to radium for the treatment of superficial and disseminated malignant neoplasms.

METHOD OF THE INDUCTION OF RADIO-ACTIVITY.

The tissues may be rendered radio-active as follows:

(1) The emanation is collected in gaseous form, or dissolved in a medium such as saline solution. In the former case the emanation may be inhaled or insufflated into the substance of the morbid tissues (Bayet). In the latter case it may be ingested by the mouth or rectum, or injected into the substance of the organs.

(2) A substance is used (Jaboin) which contains a minimal quantity of radium salt. If the salt is soluble (radium bromide) it is rapidly eliminated; if it is insoluble (especially radium sulphate) it may persist in the tissues or vascular spaces for months.

I have used this method in many cases of very different nature, but it is impossible at present to give any definite conclusions as to its efficacy.

It seems, however, certain that the injection of radium sulphate has a very remarkable and comparatively lasting analgesic effect in painful cases of cancer.

H. DOMINICI.

TREATMENT BY RADIANT HEAT AND HOT AIR.

PHYSICAL remedies have not, up to the present day, received the attention they deserve from the medical profession, and accordingly it has been left to enterprising quacks to provide and exploit these powerful curative agents ; often, doubtless, with beneficial results, but often also to the detriment of the patient and to the discredit of the method employed. Though in many cases no special knowledge or ability is needed in using these valuable remedies, yet in others medical knowledge is indispensable to the success of the treatment, not only in choosing the proper cases, but also in judiciously modifying the treatment according to the individual aspects and conditions of each case. There are probably no other physical remedial agents in whose use the operator must proceed with greater care and judgment than in the case of radiant heat and hot air, and only by a proper knowledge of their physical properties and physiological action and characteristics can the full advantage and benefit of these modern remedies be obtained.

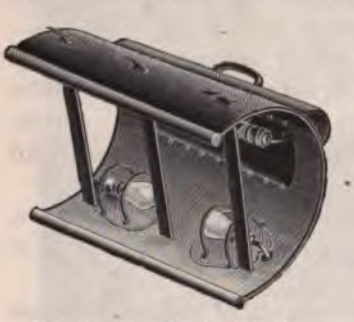

FIG. 1.—Portable limb bath.

Though radiant heat, as a therapeutic agent, differs in many respects from hot air, yet in practical work the one is often substituted for the other, because in many cases we rely for their remedial efficacy on the hyperæmia that both produce. We must note, however, that radiant heat represents the combined action of light and heat and that the sensation of warmth produced by radiant heat is not due to the temperature of the surrounding air, but is excited by certain rays, which penetrate the air without heating it. The heat of the sun, for instance, as it reaches the earth does not affect the temperature of the intervening medium. Similarly, if a screen is placed before the source of an artificial radiant heat, the sensation of warmth immediately disappears, which would not be the case if the air itself were hot (Cleaves [1]).

Hot-air applications depend on conduction of heat and not on radiation. In the incandescent-light cabinet, upon which we mostly have to rely as a source of radiant heat, the air is also heated by reflection and contact from the many lamps with which these baths are fitted out, so that we get here a combined action of light, radiant heat and conducted heat.

Both radiant heat and light are manifestations of energy transmitted to the earth by the rays of the sun, which are the source of all chemical and vital energy with which we are acquainted. Without this all life on earth would cease. Transmitted through a prism, the rays of the sun are refracted and a spectrum of a definite order is obtained, ranging from the least refrangible red to the most refrangible violet rays. This is the visible spectrum, but it constitutes only a portion of the whole. The invisible spectrum is continued on both sides of the visible spectrum; the thermal rays being located on the infrangible red side, and the chemical rays on the ultra-violet side. There is, however, no sharp definition, as they gradually diminish in intensity as

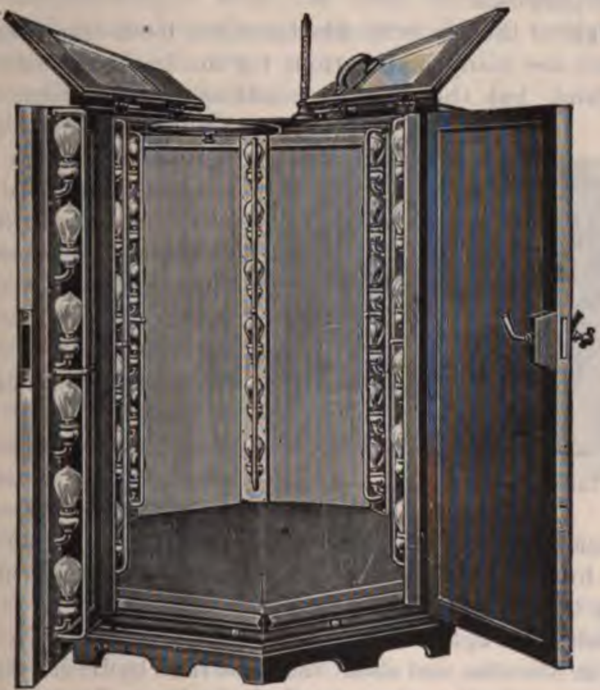

FIG. 2.—Large bath for sitting position.

they approach and, as it were, blend in the visible spectrum. Langley, who investigated the infra-red or thermal end of the spectrum, showed this part to be thirteen times as long as the visible spectrum. The length of the chemical or ultra-violet end, brought into prominence and medical importance by Finsen, Röntgen and others, is still unknown.

The sanitary and hygienic effects of sunlight are well known, and were already long ago recognised by the ancient Greeks and Romans, who built large and luxurious sun baths (solaria) for curative purposes.

The light of the sun is the ideal medium for radiant-heat effects, and there are many installations for sun baths both abroad and in England, but the climatic conditions of northern countries render this source of heat so unreliable that for practical purposes artificial sources have been substituted, in the form of the incandescent light and the electric arc-light. The incandescent light is poor in chemical rays, but comparatively rich in thermal and luminous rays, whereas the electric arc-light is a source of the more intense chemical or ultra-violet rays, and in this respect even better than sunlight, as this loses a great deal of its chemical activity in its transit through the earth's atmosphere.

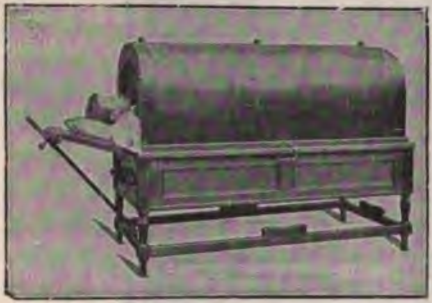

FIG. 3.—Large bath for recumbent position.

Incandescent-light baths were first introduced in 1894 by Killogg in America, and about the same time by Hedley in London. Winternitz and others interested themselves subsequently in the development of the treatment and the name of Dowsing must be associated with further improvements on technical matters.

There are baths for the whole body, either in a sitting or recumbent position, and also for topical applications to the limbs and other parts of the body, as shown in the accompanying illustrations.

Portable trunk and limb baths are useful for the treatment of patients in bed. They can be connected with the ordinary house current; and with the help of rugs or blankets quite efficient light baths can be improvised in this way for general sudatory effects or for local applications to the limbs alone.

The baths can be fitted out with white, red and blue lamps, and, at the same time, with arc-lamps, so that rays of different colours and characteristics can be employed either separately or in any combination, according as the thermal or chemical effects or both may be required in any special case. A particularly powerful local effect of the arc-light is obtained by using a projector outside the bath, whereby a most concentrated light is directed through the glass shade of the light-bath cabinet right on to the affected part of the patient.

An incandescent-light bath has been introduced lately in which special parabolic reflectors are provided in order to concentrate the rays of the lamps upon the patient, and it is claimed that in this way the effect of radiant heat is considerably increased, while the conducted heat, necessarily arising in these baths, is reduced to a minimum.

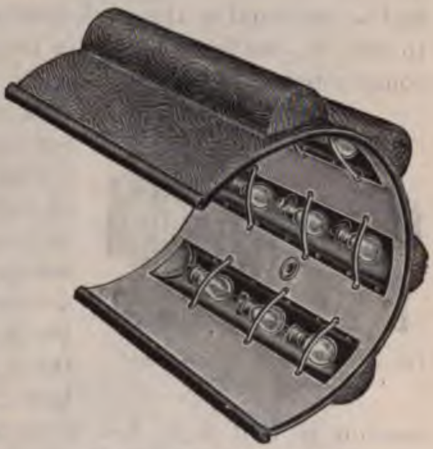

FIG. 4.—Portable trunk bath.

The fact that ordinary incandescent-light baths produce a certain amount of conducted heat has led to their use as hot-air baths, and some writers have even gone so far as to say that they are useful only for this purpose, and not for their specific light action. This view, however, is not correct, for there is a distinct differentiation of physiological action between light and hot air. At the same time we must allow that light baths are eminently useful and convenient as hot-air appliances, particularly when the exposure of the whole body is required.

For local applications, and whenever we want to produce more intense hyperæmia, hot-air baths are superior to light baths. Professor Bier claims to be the first who used hot air for clinical work, and he described his appliances for the first time in 1893. Tallerman's hot-air apparatus became known in 1895, when the first results of this treatment were published by Sibley [2] in the Lancet. Many improvements were introduced by various inventors, but all had to rely on gas, spirit or paraffin as the source of heat, and this was their great drawback, as there was always the danger of accidents necessarily associated with the use of such inflammable and explosive agents ; while at the same time the air was contaminated more or less by the products of their combustion. The advent of electricity has given a fresh impetus to this form of treatment, as it has no such disadvantages. In using it as the source of heat we can easily and readily control the temperature—a great advantage, which we could not obtain when employing the old agents.

The latest and most practical of electric hot-air appliances are those of Dr. Tyrnauer, of Carlsbad. The heating of the air is here effected by means of metallic resistances at the bottom of the apparatus, through which the electric current is conducted; and so effectual is this arrangement that a temperature of 250° to 300° F. can be obtained in ten or fifteen minutes. They are constructed to fit any part of the body comfortably, and are so well adapted that the intense heat can be applied wherever required.

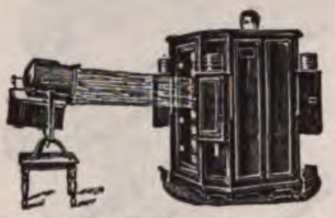

FIG. 5.—Combined "double-light" bath with projector.

Considering the physiological action of radiant heat on the human body, we must, as has been mentioned before, differentiate between the action of light and that of heat. We have a more exact knowledge of the mode of action of heat than of light ; but the general consensus of opinion is that light has a decided action on the skin, and affects also, more or less, the deeper tissues, the blood and the general metabolism. It produces a dilatation of the capillaries and blood-vessels of the skin, and determines a more active supply of blood thereto, which leads to a hyperæmic condition of the exposed parts. One of the effects of the resulting hyperæmia and long-continued exposure is the formation of pigment. This can, in a way, be considered as nature's protection against a too strong effect of light, because the pigment cells absorb the destructive chemically active rays. Long-continued action of intense light on the body, before nature has had time to call on this protection, brings about inflammatory conditions, such as severe erythemata, and even deep-seated necrosis of the tissues. Finsen[3] proved experimentally that this effect is not produced by the thermal rays, but by the ultra-violet or chemical rays.

The luminous rays penetrate the deeper tissues, but their mode of action there is not precisely known ; nor has the effect of light

the blood been satisfactorily ascertained, but we know by the
ectrum that the hæmoglobin absorbs chemically active, ultra-
let rays, and we may accordingly assume that these rays play
important part in the economy of the body, for we know that
erever energy is displayed work is done. We know also by
erience that arctic explorers, prisoners and others deprived of
t for long periods almost invariably suffer from anæmia,

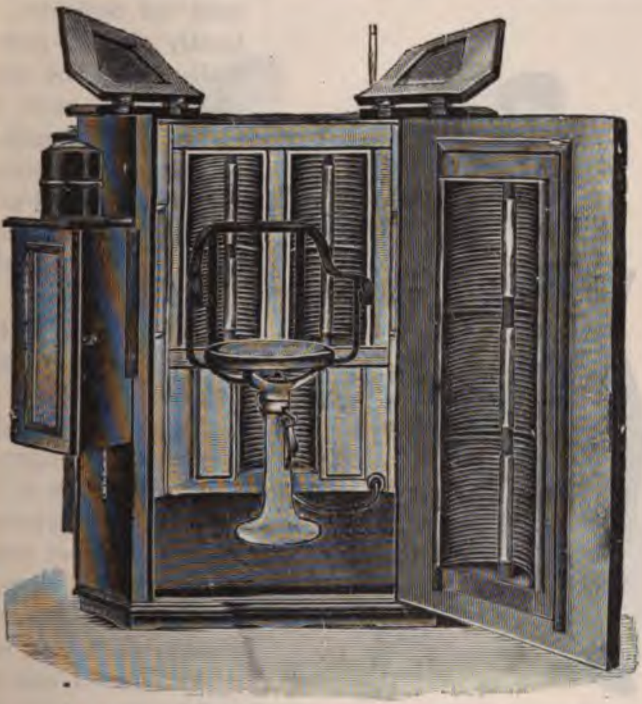

FIG. 6.—Reflector bath.

rosis, and other allied conditions, all of which show
overishment of the blood and disturbances of the general
tabolism.

ertel has shown that light causes molecular changes in the
sma of the cells by setting free oxygen to form other com-
ations, and Wolpert and others have found that under the
uence of light a greater consumption of oxygen takes place
a corresponding loss of carbon dioxide. This, however, may
be due solely to the effect of light rays, but probably to the
ltant effect of heat and light. Godnew, however, showed
rimentally that, under the influence of light alone, a greater

excretion of urine takes place, as well as an increase of uric ac and the chlorides.

Hot-air applications bring about a greater relaxation of t superficial blood-vessels, and produce therefore a much mo intense hyperæmia than light does. This is of great therapeu importance, and as Professor Bier[4] says: "Although foment tions, poultices and other heat applications, together with oth therapeutic agents, such as blistering, cupping, etc., have be used for centuries, it h hardly been sufficient realised that the benefici effects were more or le due to the hyperæmia th produce." He draws atte tion to the fact that all i portant physiological fu tions of the body a accompanied by hyp æmia — *ubi stimulus,* *affluxus* — and that defensive actions of t body against bacteria, et are also accompanied this phenomenon. Co cluding that hyperæmia one of the most importa physiological reactions the body for defence a attack, he began early make clinical use of th and became one of the p neers of hot-air treatme

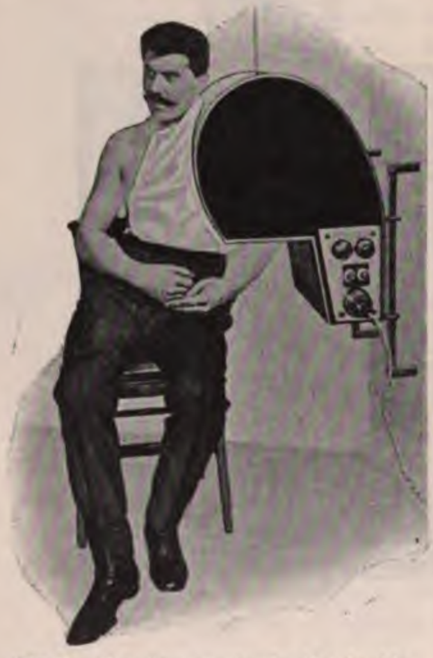

FIG. 7.—Hot-air apparatus for the shoulder.

It is well known that heat locally applied has an analge effect. This is, no doubt, due, as Ritter mentions, to sero infiltration of the tissues, which lessens the sensibility the nerve endings, but partly also to direct influences up the nervous system. The intense hyperæmia produced hot air means a greater accumulation of blood, and the fore improvement of local nutrition and metabolism. affects not only the adjacent or subjacent tissues, but, there is only a limited amount of blood in the body, t hyperæmic condition of one part is necessarily accompan by an anæmic condition of other parts—a fact which is larg utilised in the treatment for the relief of congested internal organs.

The temperature of the body is never appreciably raised by the application of heat, except on the surface, and this is counteracted to a certain extent by perspiration and by the continual circulation of fresh blood through the exposed parts.

Radiant heat represents the combined action of light and heat, but does not produce such a pronounced hyperæmia of the skin as the intense heat produced by hot-air applications. It has a more profound action upon the sweat glands, due to the stimulation of the peripheral nerve endings. We have here a distinction between hot air and radiant heat. The former develops a much more intense hyperæmia, but has slight effect on perspiration, whereas the latter does not produce such a hyperæmia, but is responsible for greater sudorific effects. In a properly constructed radiant-heat bath, as described before, perspiration sets in already at a temperature below the temperature of the blood, viz., 77° F. The pulse rate nearly always increases, but the arterial tension decreases, probably in consequence of

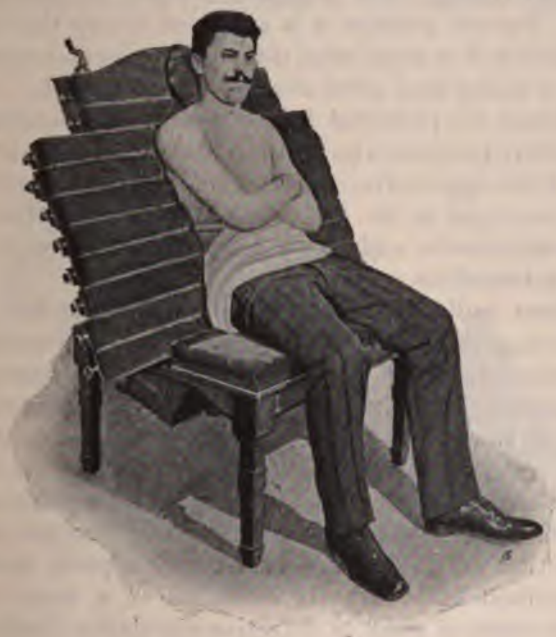

FIG. 8.—Hot-air apparatus for the back.

the relaxation of the peripheral blood-vessels. As a gene
effect it is noticed that the luminous rays of radiant heat count
act the depressing effect of heat in prolonged exposures of
whole body.

THERAPEUTICAL INDICATIONS.

It is evident that the arc-light, on account of its prep
derating chemical rays, is more useful for superficial and s
conditions. This, however, as well as the effect of different colo
is part of light therapy, and therefore outside the scope of t
discussion. For our purpose it is sufficient to say that the a
light, as a source of radiant heat, differs from incandescent lig
in that it is cooler and produces less contact heat. For t
reason it should be preferred in the treatment of cardiac ca
and for sensitive persons, who find the heat of an ordinary inc
descent bath too oppressive. Margaret A. Cleaves[1] recomme
the electric arc-light in the treatment of primary and second
anæmias, neurasthenia, and also in respiratory diseases, includ
pulmonary tuberculosis.

Incandescent radiant heat baths should answer our purp
when a thorough elimination through the skin is desired, as
Bright's disease, in manifestations of gout and rheumatism,
obesity, diabetes, etc., and they can also be advantageou
employed for stimulating effects, which may be desirable
cases of low nutrition, anæmia, bronchitis, chlorosis, etc. Un
the influence of the radiant heat the pulse becomes more and m
frequent, and at the same time fuller and stronger, show
increased action of the heart. Judiciously applied, therefore
course of radiant-heat baths is indicated as a form of he
gymnastic in cases of weak or defective circulation, feeble act
of the heart, or in general atonic conditions.

These cases must, of course, be carefully watched, and the ba
has sometimes to be stopped, even before perspiration sets
if the pulse rate should rise inconveniently high, or if ot
symptoms of over-stimulation or fatigue set in.

The chemical light effect of the incandescent baths must
be underestimated, for if the skin is very sensitive, troubleso
eczematous conditions can easily be induced. If at all app
hensive, we can easily obviate this untoward possibil
by using red lamps, and so entirely cut off the chemical ra
The experiments of Finsen[5] are instructive in this respe
He applied red light in the treatment of small-pox, and prov
that he could effectually prevent both scarring and pitting

thus protecting the patient from all irritating, chemically active rays.

The *duration of a radiant heat bath* varies according to the indications given and the result desired in each individual case. For instance, where perspiration is intended, a long exposure, up to one hour, may be necessary; while for a tonic effect ten to fifteen minutes might be sufficient.

Topical radiant heat baths can also be used for surgical affections of the joints and limbs and for the absorption of inflammatory exudates; but in these cases hot-air applications should be preferred, on account of the more intense hyperæmia they produce. The same holds good in the treatment of rheumatism, lumbago, neuralgia, sciatica, and other forms of neuritis. Great precaution is necessary in using extreme heat, particularly in cases where nerve injury exists with numbness of sensation; also in cases of elderly persons, whose skin is more or less relaxed and in a lower state of vitality. It is always advisable to protect the toes or the fingers and other prominent parts of the body by a layer of cotton-wool, so that no burns can result.

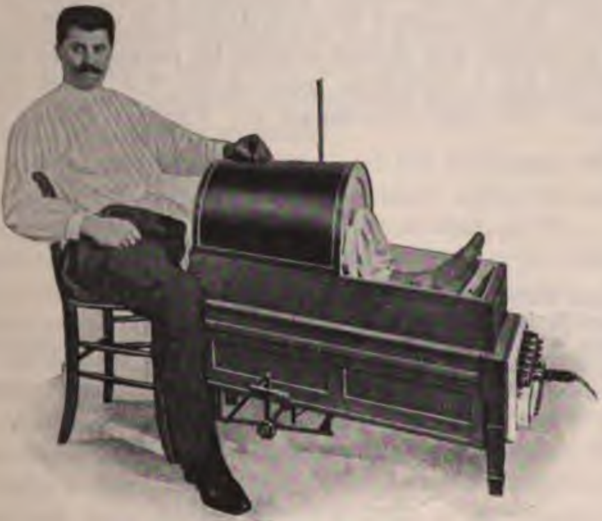

FIG. 9.—Hot-air apparatus for the knee or foot.

In arthritis deformans, in stiffness of joints due to disease or injury, the intense hyperæmia following hot-air applications loosens the joints by softening the adhesions and adjacent tissues.

In these cases hot-air applications should be followed by systematic passive and active exercises of the joints.

So manifold are the uses to which radiant heat and hot air can be put, and so various are the therapeutic indications for their employment, that it would be impossible to enumerate them all in a short article like this. Sufficient, however, has been said to show that the various physiological effects of these methods must guide us to choose that form of treatment which is most likely to be beneficial in the pathological conditions presented in each individual case. Unfortunately a perfect cure cannot be expected in all cases, but heat and light applications are also often useful as symptomatic treatment in incurable conditions. In no case, of course, need we quite depend on the efficacy of these potent remedies, but should always be prepared to supplement our efforts by a judicious recourse to the usual therapeutic measures. *See also* Treatment by Various Forms of Light, p. 186.

GUST. HAMEL.

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[2] Sibley, W. K., Lancet, 1886, II., p. 593.
[3] Finsen, N., Uber die Wirkung des Lichtes auf die Haut. Hospitaltidende, R.B.
[4] Bier, A., Hyperaemie als Heilmittel, 6te Aufl., Leipzig, 1907.
[5] Finsen, N., Über die Bedeutung der chem Strahlen des Lichtes, Leipzig, 1899.

STAMMERING.

STAMMERING, stuttering and spasmodic hesitation are all forms of a functional impediment of speech. As they are all due to imperfect cerebral control of speech the one may supervene upon the other; and for the purpose of treatment they may all be included under the one term "stammering."

Many theories have been propounded to explain the causation of stammering, but no two authorities agree. In the majority of cases which have come under the notice of the writer imitation has been found to be the cause, but where this has not been so there has always been an inherited neurotic diathesis, even although there is no inherited disposition to stammer.

Before reading the following details of the treatment which the writer has found of service in a great many cases, the article on Voice Production should be first carefully studied, p. 331.

Treatment.—It is important to urge the thorough treatment of all cases of stammering at as early a stage as possible. Parents often fail to realise this; many believing that the boy will grow out of the habit. Others, although sensible of the desirability of treatment, yet hesitate to remove their boy from school in order to have it carried out effectively. No doubt this may seem a strong measure to advise, but from the large number of failures that have been brought to him, the writer feels compelled to urge the removal of a boy from a public school for a term, or as long as may be requisite for successful treatment, so that he may afterwards be able to take his full share in the work of the school. At the same time, it would be well to utter a strong word of warning against the practice of putting several stammerers into a special class by themselves so that their education and their treatment may proceed together. Several patients have been seen who have been thus treated, but in no instance had the result been satisfactory, whilst in some the affection had been distinctly aggravated. When the habit has persisted for a long time, and the sufferer has been subjected to much worry and annoyance on account of it, the general health may suffer, and this should be attended to at once, and, if necessary, a course of bromides combined with strychnine and arsenic should be prescribed. In many cases the presence of a tight or long prepuce may lead to undue irritability of the nervous system, and therefore all male patients should be examined regard to this. If enlarged tonsils or adenoid growths are pre they should be removed.

Fortunately, we have got beyond the stage of believing stammering is due to any local defect in the mouth, a view w has been held from the earliest times, and led Demosthenes to c pebbles and Dieffenbach to perform ghastly mutilating operat by cutting out wedges of the tongue.

The patient must now be taught the method of breat described in the article on Voice Production. For that purpose breathing exercises should always be practised standing up, never lying on the back, or on a bed, as that hinders the back movement of the ribs and spine. Male patients would do we discard their braces, which prevent the upward and forward m ment of the ribs, and wear a belt or backstrap, which, as long does not encroach on the ribs, can be pulled quite tight without detriment. Every patient should have as much outdoor exer as possible, and exercises which bring many muscles into play stimulate respiration more fully. Therefore, exercises of the lo limbs, such as running, walking, skipping and hopping, are beneficial than gymnastics or monotonous exercises with du bells. Besides, in the former the ribs are free to move, whils the latter they are more or less fixed so as to form a *point d'a* for the muscles moving the upper limbs. Those who not much time to spare could not do better than go through daily exercises given in "My System."[1] They need no appara and combine both breathing and general exercises, and they ca be done in fifteen minutes.

A course of relaxation exercises according to the princi advocated by Delsarte[2] is very beneficial for those who have accustomed to clench their fists and close their jaws tightly strain the muscles of the neck in their endeavour to overcome impediment.

In the case of a very young child, when the stammering has just begun, the mother or governess may effect a cure by ge but firmly, persisting in the repetition of any letter or letters which the little one has stumbled, until it can be pronounced easily. In the older cases the two requisites for success First, that each case should be treated individually by one thoroughly knows this subject and has the tact and patie characteristic of every good teacher; secondly, that the patient willing and anxious to undergo treatment, because, without willing co-operation, even the best teacher will fail.

Let us now consider the treatment of a case where the difficulty lies with the consonants. The first step is to explain the difference between the voiceless and the voice consonants, and demonstrate how the former should be formed quickly and easily without using any breath from the lungs; and how in the latter the voice sound should be made as prominent as possible. The patient should then be asked to sing or intone a vowel, say "A" or "O," in the best tone at his command and at as low a pitch as he can take with perfect ease. He will soon be able to continue it for twenty to forty-five seconds or longer after he has practised the proper method of breathing. While intoning and sustaining the tone evenly, let him try to form one of the voice consonants without interrupting the steady flow of tone. This can best be done at first with one of the nasal tones, say "M" or "N," thus: O—MO—MO. When it is possible to continue the tone without interruption with the voice consonants, the voiceless ones should then be taken in the order given in the table. They will be found much more difficult, and at first their position should not be taken firmly, so that they will be very indistinctly heard. It will require much practice and very careful watching before they can be rendered distinctly and clearly. On no account should any breath from the lungs be heard in their formation. As soon as it becomes possible to join all the consonants in combination with all the vowels, the intoning should be dropped, and the exercises carried out in an exaggerated drawling tone, and at this stage he may begin words and sentences.

When he can say these quite easily in the drawling tone, he may begin to take part in ordinary conversation, but all the time endeavouring to keep improving the *quality* of the voice. The patient should now begin the practice of reading aloud, or repeating poetry.

In the rarer cases when the difficulty occurs with a vowel, it is always with an initial vowel, and is due to spasmodic closure of the false vocal cords. In some cases this may occur even during singing, but the spasm can be instantly relieved by trying to inhale, thereby opening the false vocal cords. In order to prevent it the patient must at first alter the proper method of voice production, and preface each initial vowel with an aspirate, thus: Ha—he—ho, the effect of this voluntary escape of breath being to prevent a closure of the false vocal cords. This extremely ugly method must be persevered with until all fear of not being able to pronounce any initial vowel is overcome. The aspiration can then be dropped, and the patient taught to pronounce each vowel clearly and distinctly.

These patients should then be put through the same exercises as the others.

As regards the duration of the course of treatment, it is very difficult to make any definite statement, as so much depends on the intelligence of the patient and the ability of the teacher. This treatment is based on the endeavour to replace a bad method of speech which has become habitual by the correct method; it is therefore necessary to continue the treatment until the correct method itself has become habitual. To do that as quickly as possible it is best that at the beginning of the course the lessons should be given daily. For the same reason, two lessons of half an hour's duration in the morning and afternoon will give more immediate results than one lesson of an hour.

GEORGE C. CATHCART.

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[1] Müller, J. P., "My System."
[2] Georgen, "The Delsarte System of Physical Culture."

VOICE PRODUCTION.

It is a strange thing how little people in general know about the voice, although so many are dependent for their existence upon its use; amongst these may be mentioned barristers, school teachers, clergymen, preachers, actors, and all who are engaged in public speaking. Many of these suffer physically, and therefore financially, from the want of knowledge of how to use their voices, but they are a small body compared to the enormous number who suffer intellectually, physically, and it may be also financially, because their teachers, pastors and masters are equally ignorant. Although it cannot be said that all barristers with good voices are successful, it will not be denied that most of those who are successful have good voices. It is notorious of those engaged in teaching that a large percentage are continually incapacitated owing to a faulty method of voice production. As for the clergy, the term "clergyman's sore throat" is sufficiently descriptive of their neglect of the fundamental principles of the art. Again, many an actor is precluded from taking a part for which his histrionic ability fits him, because his voice is not sufficiently well developed to stand the strain.

All this refers, of course, to the speaking voice, but when we consider the singing voice, if the suffering is not so general, stili it is within the writer's knowledge that every year, in this country alone, hundreds of pupils are having their voices ruined, many of them beyond repair. Not only so, but their hopes of that brilliant future to which they had so ardently looked forward, and to attain which they, and possibly their relations, had devoted all their substance, are completely shattered; and after years of unavailing labour they find themselves impoverished in mind, body and estate. The number of years spent in trying to learn an art which their teacher was not competent to teach must in the aggregate amount to a huge total, and, if we consider the money spent, the time wasted, and the consequent shattered condition of the nerves often leading to grave and permanent neurasthenia, the art of voice production becomes a subject of great importance.

Now when children are left to nature and are allowed to run about and get out of breath, provided they are not wearing tight braces, waistcoats or stays, but have their nether garments sensibly fastened round the waist, care being taken that the ribs are le free to move and the chest to rise, they will breathe instinctivel in such a way as to develop the upper part of the chest and th whole of the lungs. Yet, in this country, in the public elementar schools, and most of the private ones, the "Tonic Sol-fa" metho is taught to every child. This method has had grafted on to it method of breathing and of controlling the breath during voice production which is not only unscientific, being anatomically physiologically, and physically wrong, but also most pernicious i its effects, as it hinders the proper development of the chest. B this method of voice production, at a period when owing to th resiliency of the chest walls the full development of the chest woul naturally take place, the children are systematically taught method of breathing which prevents the lungs from being properl developed, and thus lowers their resistance to disease. That thi is a matter of the utmost urgency from a medical point of view obvious when we consider that in this country there are 60,0 deaths annually from consumption, and that this means a disea incidence of at least half a million. Thus, from a purely medic point of view, the subject of "voice production" becomes one n merely of great but of national importance.

When the writer first took up the study of voice production order to cure himself of defects in the speaking voice he tri various masters in this country without any beneficial results, b rather the reverse. Having observed that a really good singer w able to make his voice carry more easily and distinctly than a speaker, he came to the conclusion that the best way to get a goo resonant voice for speaking was to study singing. The writer h the great advantage of studying with the late Signor Scafati Naples, who was a pupil of Crescentini, the last of the great ma sopranos, and was thus a direct representative of the old Itali school of voice production. From him he learned the fir principles which underlie the teaching of the old Italian scho Now these first principles, like the first principles of any subje are easy to understand, but the explanation of them is not alwa easy, and although they were arrived at empirically, they must founded on a true scientific basis, because they gave perfect result and it will be found that when the modern school differs from t old teaching on so-called scientific grounds, it is really only pseud scientific.

An endeavour will now be made to expound these principles briefly as possible.

For the production of the voice three things are necessar

First, the lungs containing the air which, when it is expelled, acts on the vocal cords. Secondly, the vocal cords, which by their movement produce the sound of the voice. Thirdly, the resonating cavities, which reinforce the original sound made by the vocal cords.

The old Italian school had discovered that the whole secret of cultivating the voice to its highest perfection lay in the complete development of the resonating cavities. These are the chest, ventricles of Morgagni, pharynx, naso-pharynx, and mouth, and they differ fundamentally from the resonators of every other instrument because they are constructed with soft walls. This accounts for the fact that the chest, the pharynx, and the mouth can alter their shape and still keep up the same amount of resonance. An experimental proof of this has lately been given by E. W. Scripture[1] in his work, "Researches on Experimental Phonetics." On p. 110, when discussing "Wave Analysis in reference to Vocal Action," he says: "Still another reason for neglecting the over-tone theory lies in the fact that it is based on views of resonance which are not valid for the voice. Helmholtz supposed the vocal cavities to act as a series of resonators which respond to definite over-tones in the glottal tone. Such a supposition would be appropriate if the cavities were made of metal or other hard substance. The vocal cavities have, however, soft or moderately hard walls lined with moist membranes. The laws of resonance for soft cavities are different from those for brass resonators. The experiments on resonance summarised at the end of this chapter show that cavities with soft walls respond to a range of tone which increases as the softness; for example, a cavity with walls of water will respond to any tone, a cavity with flesh walls to a considerable range of tone, etc. The same conclusion can be deduced theoretically. The process of vowel production must therefore differ completely from the theory that compares it to the response of hard resonators to over-tones."

The first resonator is the chest, and it is obvious that the larger it becomes the greater will be the size of the tone which it resonates, and therefore the first essential to make it fulfil its function as a resonator is to increase the size as much as possible. The old Italian school taught that there were two kinds of breathing, of which one was carried out chiefly by the diaphragm, and was characterised by the swelling out of the front abdominal wall and lower part of the chest, and was the proper kind of breathing during sleep; the other was characterised by an increase in size of the upper part of the chest, accompanied by a sinking in rather than a swelling out of the front abdominal wall. By the latter method the lungs are also inflated to their greatest possible extent with the least possible exertion, and thus enabled to take in a very large quantity of air.

This is the very antithesis of the modern procedure in regard to breathing as initiated by Dr. Mandl, in France, and propounded in this country by the late Dr. Lennox Browne and Mr. E. Behnke.[1] According to these authorities "*the criterion of correct inspiration is, as before stated, an increase in size of the abdomen and of the lower part of the chest. Whoever draws in the abdomen and raises the upper part of the chest in the act of filling his lungs, breathes wrongly.*" Unfortunately, these statements are to a certain extent backed up by physiologists, who are not generally versed in the principles of voice production. They have divided respiration into two classes, natural, normal or ordinary respiration, performed by the diaphragm, and forced or extraordinary respiration, when muscles other than the diaphragm are mostly called into play. Of course, one method is as natural and ordinary as the other; the one is used during sleep or repose, and the other during exercise, and singing or speaking are forms of exercise. If we look at the subject from the point of view of the nervous control of the muscles of the thoracic cage it will be seen that they have two separate and distinct actions; in fact, Dr. Hughlings Jackson, in his lectures on the respiratory centre, divides the duties of the thoracic cage into: (1) Their organic service, or the "menial work" of respiration proper; (2) their manifold voluntary services which are mainly of cerebral initiation. The organic service, or the "menial work" of respiration proper, is carried out by the well-known respiratory centre in the medulla, which acts upon and controls the laryngeal, diaphragmatic, and costal muscles.

In ordinary quiet respiration, which can be well observed in a sleeping child, it is the diaphragm which is chiefly brought into play, the action of the other muscles being relatively slight.

In the voluntary services of the muscles of the thoracic cage, as in singing and speaking, or in a howling infant, in voluntary fixation of the chest, and in deep voluntary inspiration, the capacity of the chest is increased by the action of the muscles acting on the upper ribs to a much greater extent than during ordinary respiration. The upper part of the spine moves backwards, and the ribs are moved backwards and outwards, and then upwards, carrying with them passively the sternum and the inner ends of the clavicles which are attached to it. These movements are carried out by the serratus magnus muscle, which is supplied by a special nerve called after its discoverer, Sir Charles Bell, "the external respiratory nerve of Bell." The front abdominal wall sinks inwards instead of protruding as in diaphragmatic respiration, and the action of the diaphragm is relatively slight.

These voluntary movements of the chest are entirely initiated and controlled by the cerebrum, and not by the respiratory centre in the medulla. In fact, during these movements the respiratory centre is inhibited by the cerebrum, and continues out of action till the blood becomes so venous that the respiratory centre is forced into action and compels the stoppage of voice production and the taking of breath.

It is only by using this thoracic method of breathing that the chest and the other resonators can be fully developed.

The next resonator is a double one and consists of the two ventricles of Morgagni, which are situated above the true vocal cords, separating them from the false vocal cords. Although these ventricles are not very large in man, and not to be compared to the great size of those possessed by the howling monkeys, yet, bearing in mind that their walls are lined with a moist mucous membrane, they are probably of considerable value as resonators. At any rate, the writer has always found that the better the voice the more the ventricles were developed.

After the chest the most important resonator is the pharynx. Upon its proper development and use depends all the richness, quality and depth of tone of a well-produced voice, and herein lies the difference between the voices of the old school and the voices of the modern school. The pharynx can be enlarged in three directions: from top to bottom, from side to side, and from back to front. It is another of the secrets of the old Italian school that it cannot be enlarged from side to side, or from back to front, until it is first enlarged from top to bottom, and it can only be so enlarged by causing the larynx to sink. Now the extent to which the larynx descends is entirely dependent upon the extent to which the lungs are inflated. The greater the inflation of the lungs the more the trachea sinks down into the chest, thereby carrying the larynx with it. It is for this reason that the old Italian school attached so much importance to thoracic breathing. The writer well remembers hearing Signor Scafati say to a bass whose voice he was trying: "Voi respirate troppe basso, Signore." ("You are breathing too low.") This bass had been trained in England to try to produce a low note by breathing as low as possible in the abdomen, whereas, Signor Scafati was able to show him at the first lesson that he could get several lower notes by breathing high, and so causing his larynx to descend, than he could by breathing low and letting his larynx stay where it was.

The next resonator is the naso-pharynx, which differs from the others in being to a great extent a fixed resonator; but there is one side of it which is movable, and that is the soft palate. This partition can be altered at will to such an extent that the uvula can be drawn up entirely out of sight. This last manœuvre, however, according to Signor Scafati, should never take place. In his own throat I observed on numerous occasions that the front part of the soft palate became tense, but the uvula was always hanging down, even when he was singing the top "C." Signor Scafati maintained that this resonator, or in other words the action of the soft palate, was developed *pari passu* with that of the pharynx, and that when the pharynx was fully developed the naso-pharynx would be found fully developed also. He laughed to scorn the modern practice, so much in vogue, of humming through the nose as a means of acquiring what he called "the head sound," as this could never be properly acquired except by developing the pharynx. He maintained that this attempt merely produced strongly marked nasality, which the uninitiated mistook for genuine nasal resonance, and that the strength of the buzzing felt in the head was no criterion of the amount of vibrations that were heard by the listener. He repeated time and time again that when the sound was perfectly produced it should not have a nasal quality and there should be then no feeling of dizziness from the vibrations in the head.

Furthermore, the practice of humming, however arduously it is carried out, in no way assists the student to get the throat free and open, nor does it prevent the tone being held in the throat and giving rise to that throaty tone so commonly heard in singers, especially tenors trained on modern pseudo-scientific lines.

The last resonator is the mouth. This is really divided into two, one at the back and one at the front, so that, as Signor Scafati used to point out, each vowel sound ought always to have two resonances. The back resonator is developed as the pharynx is developed, and the one in front only comes into full play through the development of the back one.

Let us now pass to the consideration of the mechanism of speech, and let us see how the resonators are brought into action.

This leads us to the formation of the vowels and consonants. These are the component parts of the syllables and words of which a language is built up.

For the formation of the vowels three mechanisms are called play: First, the respiratory; second, the laryngeal; third, oro-nasal mechanism, which, by means of the tongue, palate, teeth and lips, finally moulds the voice sound into the different vowels. A vowel is thus a continuous voice sound which is not obstructed by the approximation of the tongue to the palate and teeth, or by the lips. If we look at the following table of consonants drawn up by Alexander Melville Bell in 1849, it will explain the main differences between the consonants.

Voiceless.	Voice.	Voice and Nasality.
p.	b.	m.
f.	v.	
wh.	w.	
t.	d.	n.
th.	th (dh).	
	l.	
	r.	
s.	z.	
sh.	zh.	
	y.	
k.	g.	ng.

From this table it will be seen that, like the vowels, the consonants in the second and third columns have a continuous voice sound, but it is obstructed in whole or in part by the approximation of different parts of the tongue with the different parts of the palate or the teeth, or by the closure of the lips, and that they likewise employ the three mechanisms above stated. The consonants in the first column, or one-third of the whole, differ entirely from the others, in that they do not make use of either the respiratory or the laryngeal mechanism; in other words, there is no voice sound in them, and their expulsive power comes only from the pharyngeal walls, in no case should it come from the breath in the lungs. This is the way in which all good singers of the old Italian school produced these consonants, and all singers and speakers who desire to produce their voices properly must learn to do the same.

Probably no subject in connection with voice production has given rise to greater controversy than that of the registers; but before the invention of the laryngoscope the mode of action of the vocal cords was unknown, and the three registers into which the old Italians divided the voices were due to the three changes of resonance in the voices of beginners, heard by the ear, and had no reference to any changes in the action of the vocal cords, which could be seen by the laryngoscope. These three registers were called the head, middle, and chest, because in the upper the resonance from the head was slightly more pronounced, in the lower that from the chest, whilst the middle did not partake of any resonance either from the head or the chest. Ultimately, in the trained voice, all the notes, from lowest to highest, had to be produced with chest and head resonance, so perfectly blended that the singer had no need to think whether he was going to sing low or sing high, because each note was equally easy, and he could give his whole mind to the expression that the music demanded.

As far as controlling the breath is concerned, this was learned *unconsciously*. Signor Scafati did not trouble the pupil with any directions to hold back the breath during the elementary stage, well knowing that by the time all sense of "push" had disappeared the tone would have become balanced, and there would no longer be any waste of breath. Signor Scafati did not know how the breath was held, he only knew that it was held in the larynx, and that all efforts to control it *consciously*, by "*consciously* keeping the ribs extended and the midriff down," invariably led to the voice being stiff and throaty. This, of course, differs from the theory prevalent in the present methods of teaching. We know now since Wyllie's discovery of the function of the false vocal cords in 1866 that the breath is held in the lungs by the closure of the false vocal cords, but whether the breath during singing is held, or is not held by the false vocal cords, does not matter one jot to the singer so long as he learns to hold it *instinctively* by listening with his ears for a good tone, and not by *consciously* making the muscles of inspiration act against the muscles of expiration. This is another good example of the pseudo-scientific teaching of the modern school, which leads to disastrous results. For instance, in "Voice, Song and Speech," on p. 146, there is this statement: "A little consideration will show that it is wrong to try and control the exit of the breath, as some would have us do, by a contraction of the glottis, because the comparatively tiny muscles of the larynx are too weak to resist with impunity so tremendous a strain; while the large and powerful muscles of the chest are clearly made to regulate expiration as well as inspiration. It is absurd on the face of it to suppose that they are only intended for inflating the lungs, while the exit of the air is to be governed by another set of small muscles, situated at a great distance and having their full share of work in the marvellous and ever-varied combinations which are necessary in the production and graduation of tone."

A slight knowledge of the laws of physics as applied to the Bramah Press would have prevented this statement being made. It is just because the tiny muscles of the larynx are situated at the top of a long narrow tube, of which the cross section is so very much smaller than the thorax, that they are able to control with the greatest ease both the entrance and the exit of the air. This action of the false vocal cords is very important, and unless it is fully understood, it is impossible to explain or remedy what takes place in cases of spasmodic hesitation of speech.

This, then, is a brief summary of the first principles, but to apply them throughout the voice required many years of patient practice. The result, however, was perfect. The old singers were able to sing *every* note of their enormous compass equally well, and loudly, or softly, at will; but in those days masters and pupils alike were content to devote themselves to this arduous task.

The speaking voice was trained in the same way, but owing to its comparatively small compass the time taken to train it was much less.

It should be carefully noted that all the old singing masters were men, and the voices of men and women were treated alike. No endeavour was made at the beginning of the training to prognosticate whether the voice was going to be soprano, contralto, tenor or bass. The training was begun at the part of the voice which was found to be most easy, and the development was carried on, up and down from that point, until the voice showed in itself whether it was going to be a high or low one.

Were these principles but carried out at the present time there would be no reason why the art of the *bel canto* should not be revived in England, so that English voices would no longer be thin, colourless and monotonous. An enormous sum of money also would be saved which is now wasted on voice production, only to result but too often in bitter disappointment, both artistic and financial. Not only would such conditions as "clergyman's sore throat" and the chronic laryngitis so common in all classes of voice users, together with the nodules found on the cords of singers and teachers, never occur, but it is only by following out these principles that they can be truly cured. Even though the results of bad voice production may be removed by medical means, there will always be a recurrence unless the method which caused them is changed.

Further, and perhaps most important of all, the direct development of the lungs and full breathing capacity which this method entails would not only strengthen the bodily system as a but more particularly enable the lungs to resist the at tuberculous disease.

GEORGE C. CATHC

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X-RAY TREATMENT OF SKIN DISEASES.

early days of the employment of X-rays in medicine hardly a skin disease which was not subjected to this)f treatment. The limits for its application are now iown, and, while it has been found that X-ray treatment ed for many skin affections, in others its value has been blished. The introduction of accurate means of measuring ut of X-rays, by enabling us to dose with precision, and al adoption of protective measures for the operators, have tically eliminated the dangers of this method in the hands workers.

ea that the majority of practitioners should personally the X-ray treatment of skin affections is not, of course, ertained; but X-ray treatment has become so important in the therapeutics of skin diseases that most medical t find it helpful to know in what class of case the treatment and the manner in which it is employed in different ts. There are some, however, among general practitioners iake use of X-ray apparatus who may, I hope, find somethese pages which will assist them in the application of il remedial agent. On the other hand, this article is not for the instruction of beginners; and it cannot be too urged that no one should undertake X-ray treatment of tions without having had first of all a considerable amount al instruction in a clinic for radio-therapeutics.

r **Methods.**—Before the invention of precise means of was the custom to apply the rays during short sittings, every few days over long periods, until some improvement ed, or until a mild inflammatory reaction took place. By iod there was always the danger of giving an overdose, for effect of any one application of X-rays does not appear days or a fortnight afterwards. Since the sittings were right up to the time when the reaction was noticed, en during the last week or so were more than were , and burns were sometimes produced. In some cases ler doses were continued over many months, so that the ted received hundreds of applications; and in this way great danger of the production of X-ray dermatitis.

Present Methods.—At the present time we are able to administer in a single measured dose exactly that amount of rays which can be absorbed by the skin without damage to the normal tissues. We have to remember the fact, already mentioned, that the full effects of this dose will not be felt until ten to fourteen days after it has been administered; and, also, that its influence will continue for several days longer. Consequently, if it is necessary to give a second or more doses to the same area, we must put an interval of three or four weeks between the doses. It follows that, in place of a very large number of feeble doses at intervals of a few days, we now give a single full-measured dose, once in three or four weeks, with equal or, generally, greater efficacy, and with far greater safety. There are some operators who prefer to administer "half doses" at shorter intervals, but personally I have not found any better results by this method, unless under exceptional circumstances to be presently mentioned; and I am of opinion that it is preferable generally to work with "full doses" at long intervals.

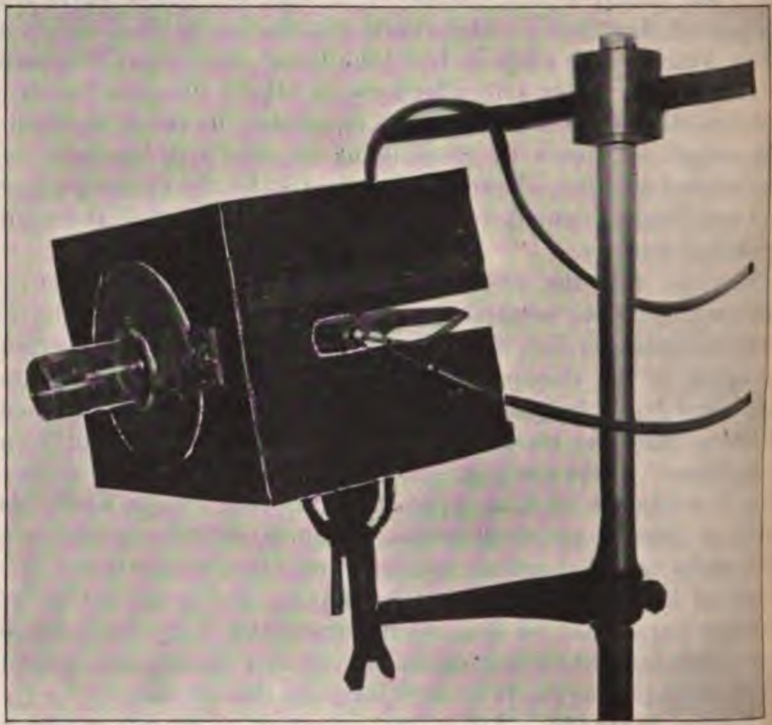


FIG. 1.—Box-shield, with lead-glass localiser.

I have already said that it was formerly thought necessary to produce an inflammatory reaction. Now we generally try to avoid this, because it is known that inflammatory reaction, according to its degree, is followed by more or less permanent damage to the skin.

The principle upon which we act is the direct destruction of the diseased structures without damage to healthy tissues. The therapeutic effects of the X-rays are due to their destructive action upon living cells. But the less stable cells succumb more readily than the more hardy, or, in other words, the cells of disease are generally destroyed by a smaller dose than are the more stable cells of the normal tissue around them. By accurately measuring the dose we are able to give to an affected part just sufficient X-rays to destroy the cells of disease without harming the healthy cells.

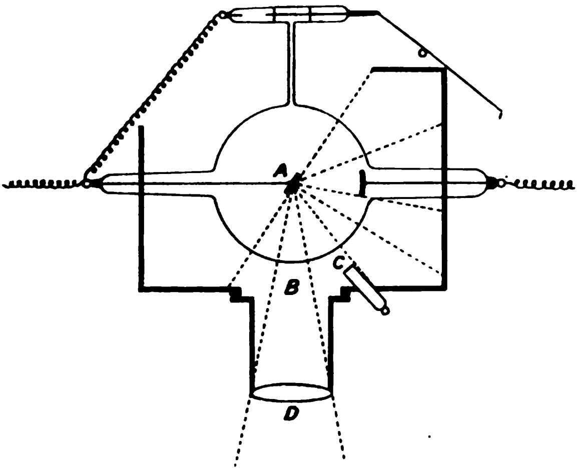
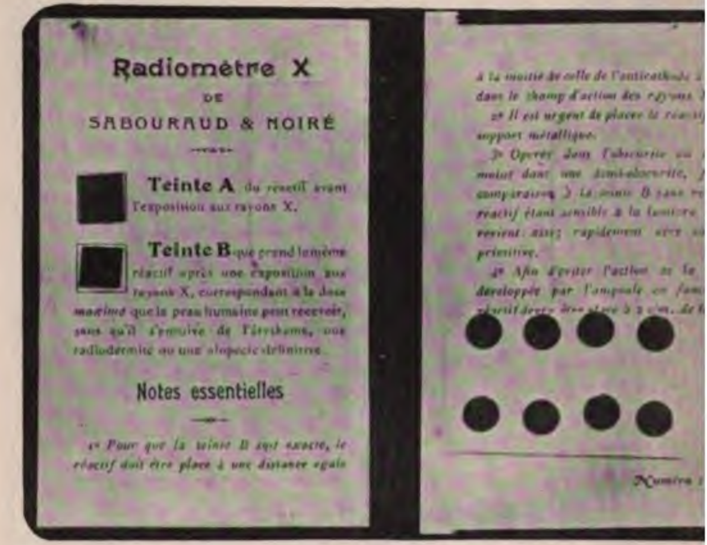


FIG. 2.—Diagram of box-shield shown in Fig. 1.
A, antikathode—source of rays; *B*, aperture in box-shield; *C*, pastille holder; *D*, lead-glass localiser.

We apply the same principle when we expose the skin to the X-rays for the purpose of causing temporary fall of hair, or for modifying the skin functions of sweat production or of sebaceous secretion. We give a dose which is just sufficient to destroy the delicate cells of the hair papilla or of the gland structures without harming the more hardy cells of the tissue around. The application of this principle will be referred to in more detail later.

Protection of the Operator.—In the early days of X-ray thera-eutics the X-ray tube was used " naked " or uncovered, so that the perator was continuously exposed to the rays. Later, protective prons and gloves were used. Now, a much more effectual and

more simple method of protecting the operator is un
employed. The tube is enclosed in an X-ray-tight box
with an aperture at one part through which alone the ray
and by which their incidence is limited to the particular ar
patient's skin which it is desired to treat (Fig. 1). The
conveniently made in the form of a wooden box, which is l
a metal-containing composition to render it impervious to
At one side is the circular aperture, upon which may be fit
glass cylinders of different sizes, according to the area to b



Radiomètre X
DE
SABOURAUD & NOIRÉ

Teinte A du réactif avant l'exposition aux rayons X.

Teinte B que prend le même réactif après une exposition aux rayons X, correspondant à la dose maxima que la peau humaine peut recevoir, sans qu'il s'ensuive de l'érythème, une radiodermite ou une alopécie définitive.

Notes essentielles

1° Pour que la teinte B soit exacte, le réactif doit être placé à une distance égale

FIG. 3.—Book of pastilles of Sabouraud and Noiré.

These cylinders are of such a length that the free-end
applied to the skin is at a uniform distance from the sour
rays at the centre of the X-ray tube. Sometimes, instead
lead-glass localisers, it is more convenient to keep the pa
treatment at the proper distance from the source of the
means of three slender wooden pegs fixed round the marg
aperture and converging at their points, which lightly t
skin (Fig. 6). The normal skin may then be protected b
of lead-foil, having a hole accurately cut to allow of exposu
lesion only. The pegs are also useful if rays are to be a
an area larger than that allowed by the cylinders, as in
the whole scalp for ringworm by the method which will be
described.

Protection of the Patient.—The following remarks in regard to protection of the patient by accurate dosage apply only to the treatment of skin affections. In the treatment of deeper organs the conditions are altogether different, and the skin is protected by means of filters according to the method described by Dr. Ironside Bruce (*see* p. 361).

The patient is protected from the harmful effects of the rays by (1) limiting the exposure to the part to be treated; (2) by accurate dosage.

The means by which the dosage is controlled are as follows:

Regulation of the distance of the part exposed from the source of the rays; measurement of the amount of current passing through the tube; estimation of the quality of the rays employed; duration of the exposure; adjustment of the interval of time between the exposures. The most important of these in practice are:

(*a*) Regulation of distance from the source of the rays.

(*b*) Measurement of the actual dose emitted as represented by quality × quantity.

(*c*) Proper spacing of doses in point of time.

The most convenient distance has been found to be 6½ inches.

The actual amount of the dose of X-rays is obtained by means of the pastille of Sabouraud and Noiré (Fig. 3). This pastille is made of platino-cyanide of barium, a substance which has the property of changing colour, from bright green to yellow, under the action of the X-rays. The pastille is placed in the path of the rays at a fixed distance from their source, and the exposure is continued until the pastille changes colour to a certain standard tint of yellow, known as the *B tint*. The part exposed has then received just that dose which it can absorb at one sitting without subsequent damage, *i.e.*, a "full pastille dose." This dose is also just that which will cause depilation without permanent baldness. Such a full pastille dose must not be repeated on the same area until after an interval of three or four weeks.

In the box-shield there is a slot, into which can be pushed a holder, upon the end of which is fixed the pastille to be exposed, and which is so arranged that the pastille is exactly half-way between the centre of the X-ray tube and the skin during the exposure. The half-way point is chosen because the pastille is not sufficiently sensitive to undergo a marked change of tint if placed on the part which is being treated.

In using the pastille it is of the utmost importance to remember:

(1) To fix it at the proper distance.

(2) To protect it from daylight, and to avoid so exposing it for

more than a moment while comparing its tint with the standar because it returns to its original green colour in daylight.

(3) To take the colour no further than the standard tint.

(4) To beware of pastilles and standard tints not made by t original makers, Drault, of Paris. Even recently there were bei sold in this country pastilles professing to be genuine Dra pastilles, but with a false standard tint. Only the standard tint Drault's book of pastilles should be used.

The time occupied in giving a full pastille dose will vary fro twelve to twenty-five minutes according to the quantity and quali of the rays emitted. These two factors depend upon the amount current passed through the tube and the degree of vacuum of t tube, and to a certain extent we can arrange approximately h long the dose is to take by adjusting these. The most conveni time for a dose to occupy is fifteen to twenty minutes. If we atten to give a dose in less time than this there is but little margin for err with the larger dose there is a margin of safety of one minute or

Further details of the X-ray apparatus and of how to use cannot be given here. The proper management of the X-ray tu can only be learnt by practical experience. Those points wh have been mentioned are so important that they cannot be calle mind too often by those who actually use the X-rays in treatme while some knowledge of them is necessary for a thoro appreciation of the use of the method in the various affections n to be considered.

SKIN DISEASES IN WHICH X-RAY TREATMENT MAY B EMPLOYED.

The skin affections which experience has taught us are m suitable for X-ray treatment may be conveniently divided i three groups, namely: (1) Those in which the lesions are made of a new growth of fixed cells; (2) localised chronic inflammat affections; (3) where the treatment consists in modifying so normal function of the skin—growth of hair, sweat secreti nerve functions, etc.

(1) AFFECTIONS IN WHICH THE LESIONS ARE MADE UP A NEW GROWTH OF FIXED CELLS.

The two best examples of this group are common wa and rodent ulcer. These are affections in which there is new growth of epithelial cells, and in which the cells for ing the new growth are of a more embryonic, more rapi growing, and less stable type than those of the normal epidermis from which they have sprung and by which they are surrounded. By exposing these growths to properly measured doses of X-rays, we can destroy the less stable cells of the new growth without harming the healthy cells.

In contrast with these localised overgrowths of fixed tissue cells which are suitable for X-ray treatment are *nævi and moles*, which are also of the same nature, but which are not suited for X-ray treatment. The reason is that the cells which make up these growths are of congenital origin and not comparatively recent growths; consequently they are as stable as the cells of the surrounding tissues and cannot be destroyed, except by a dose which would damage the normal skin and produce an X-ray burn. The production of an X-ray burn, followed by a scar which is liable to give trouble, owing to its tendency to break down, or possibly even to become the seat of malignant disease, is not justifiable in the case of a simple mole or nævus.

Common Warts.—There are many ways of destroying ordinary warts. Among others are the methods of excision, of painting with caustics, of electrolysis, of freezing with solid CO_2. But when there are large numbers of warts grouped together upon the hands or upon the face, a rapid and painless method, and one which has the advantage of leaving absolutely no scar, is that of the application of X-rays. A single "pastille dose" is given, and, in most instances, the warts on the area exposed shrivel up, and disappear without leaving any trace, in from two to four weeks. It is necessary to give quite a full dose, for with anything less the warts merely subside and then grow again, sometimes more luxuriantly. Should the first dose not cause the warts to disappear, a second dose may be given at an interval of not less than one month from the first. It is advisable when exposing warts to the rays to cover the parts with thin lead-foil, in which are cut holes for the warts. This enables one to give quite a full dose without risk of slight erythema or temporary pigmentation, which, in some persons, results from a full pastille dose to the hands or face.

Rodent Ulcer.—Rodent ulcer is a disease in which X-ray treatment is highly successful. It cannot be regarded as a certain cure for every case, but it is more widely applicable than any other form of treatment for rodent ulcer. In some cases excision is to be recommended as the quickest and most certain cure, but there are many instances of rodent ulcer which, owing to their position or extent, cannot be removed by the knife without considerable deformity. In old people X-ray treatment is often preferable to excision, and in younger patients a properly regulated treatment by X-rays can do no harm, even if, as very seldom happens, excision should be found necessary later. Unfortunately there are many extensive cases of rodent ulcer which are beyond surgical treatment, and which also prove resistant to X-ray treatment.

The method of procedure is as follows: The growth is exposed to full pastille doses at intervals of three weeks. For a small rodent ulcer from four to six sittings may effect a cure. The ulceration heals under a scab, leaving a fine supple scar. For larger ulcers many more sittings may be required, and it is often of advantage to pare off the growth at the margin of the ulcer with a scalpel.

But all cases of rodent ulcer do not respond so readily to X-ray treatment, and when the growth fails to disappear with pastille doses at normal intervals, the usual proceeding may be modified and the interval between the doses reduced to two weeks or even to one week. Or the dose at each sitting may be increased by half or doubled. If these measures are taken the normal skin around must be carefully protected by lead-foil or by a lead paint, so that the action of the rays is limited to the area of the growth. Broca, of Paris, has recently described a method employed by himself of giving very large doses of X-rays in certain skin affections, notably in epithelioma or in rodent ulcer. He has been in the habit of giving from four to six pastille doses at one sitting to such lesions, and by this means obtaining a very rapid cure. The essential point in this method is to cover up very carefully the sound tissues around and quite up to the growth or ulcer with a paint made of red oxide of lead and turpentine. By this means the sound skin is protected, and it has been found that the new growth disappears without ulceration and leaving a healthy scar. The healthy skin may be still further protected from the harmful effect of the rays by means of strips of Vigo's plaster put over the paint.

Epithelioma.—Malignant epitheliomatous growths from the skin have hitherto been found to be not so amenable to treatment by X-rays as are rodent ulcer growths, and because of this uncertainty of the effect of X-rays, and on account of the tendency to gland infection, more radical measures have been preferred to X-rays in the treatment of epithelioma. As a rule, therefore, it was generally considered advisable not to treat by X-rays any malignant epitheliomatous growth which was removable by surgical operation. An exception was made in the case of the small multiple indolent epitheliomatous growths which occur on the face in association with senile degeneration of the skin (senile keratosis). These are not easily treated by excision on account of their multiplicity and their situation in unhealthy epidermis. They disappear readily under X-ray applications, and the condition which has given rise to them improves with the same treatment.

With the introduction of Broca's method of intensive radiotherapy, mentioned in the last section, it seems probable that other forms of malignant epithelial growths of the skin besides rodent ulcer will be cured by X-rays. Broca has indeed had strikingly successful results in such cases.

(2) CHRONIC LOCALISED INFLAMMATIONS.

Into this group we may put all those affections of the skin which are the result of chronic inflammatory processes of limited extent. The list includes acne vulgaris, acne rosacea, some forms of lupus vulgaris, sycosis menti, localised areas of chronic eczema, of lichen planus, or of psoriasis and chronic inflammatory affections of the nails. In all these affections very good results are obtained by X-ray treatment.

The way in which the rays act upon chronic inflammatory lesions is not altogether clear. It seems probable that they directly destroy the inflammatory cells just as they do those of new growths, and that these, being less stable than the cells of normal tissue, are affected by smaller doses.

Acne Vulgaris.—Excellent results may be obtained by the X-ray treatment of acne vulgaris. It is not, however, to be recommended as a routine treatment, because in most cases of acne a cure may be brought about by more ordinary methods. Acne vulgaris may generally be cured by persistent use of soap, sulphur lotion, expression of the comedones, and opening up of any papulo-pustules. But in obstinate cases X-ray treatment may be employed with certain knowledge that a complete cure will be effected. It is, of course, essential that the treatment be carried out carefully and by measured doses. Cases of atrophy of the skin of the face following X-ray applications for acne, such as have been reported from X-ray treatment as used by the older method of haphazard dosage, should never occur again. The result of the X-ray treatment of acne punctata is a disappearance of the greasiness of the skin and of the comedones. The only drawback is that in some skins a temporary bronzing is produced, which is conspicuous on account of the sharp contrast between the bronzed areas and the whiter untreated parts. But this does not always occur, and it always passes off in time.

The method of procedure is as follows:

(1) The eyes and eyebrows and the hair bordering on the

forehead and temples are covered with lead-foil as a protection from the rays.

(2) Somewhat less than a "pastille dose" of X-rays is given to (*a*) the forehead, (*b*) the right cheek, (*c*) the left cheek, each dose being aimed at the centre of each of these parts, and at right angles to the direction of incidence of the other two doses.

(3) The dose is repeated at intervals of one month until improvement is noticed, generally after two to four doses.

In the case of a pustulating acne it is well to begin with half-pastille doses, as sometimes a violent reaction is produced with larger doses, and although this subsides without harm and with much improvement of the original condition, it is alarming and inconvenient at the time. But with perseverance, with properly measured doses at measured intervals, even bad cases of pustular and nodular acne may be cured by X-rays.

Acne Rosacea.—Very good results are also obtained in acne rosacea by X-ray therapeutics. But there is one great drawback to their use in these cases, namely, that "pastille doses" (which in my experience are alone efficient in most instances) are very apt to produce a marked inflammatory reaction of the erythematous and nodular areas. In from six to eight days after the application the parts exposed become red, hot and swollen, with a feeling of burning and tension. This lasts for a week or more, and compels the patient to remain indoors and shut off from society. But there is marked improvement after the subsidence of the reaction, and although the patient may have complained bitterly during the time of inflammation, she is always willing to undergo a second application. The result is lasting, though not always permanent.

Sycosis.—Sycosis menti is now known to be a staphylococcic infection of the hair follicles, and its obstinacy to the older treatment of depilation with forceps and application of antiseptics led to the hope that staphylococcus vaccines would give good results in these cases. But vaccine treatment, though giving brilliant results in recent staphylococcus infections of the skin, is often disappointing in chronic infections like sycosis, and in my experience more rapid and more certain cures are to be got from X-ray applications. In sycosis, as in pustular acne and acne rosacea, there is often a temporary violent exacerbation of the inflammatory condition after the X-ray applications. This evil may be mitigated by exposing only single areas at a time, as, for example, one cheek or the chin. Half-doses are of no use in sycosis, because depilation is required, and only "pastille doses" will cause this. The result of a "pastille dose," after the subsidence of the inflammatory swelling, is a th hairless patch of skin free from redness or pustules. The is completed when every part of the beard region has been red hairless and free from pustules. The hair-growth returns m six weeks to two months after the depilation.

oriasis, chronic eczema, patches of chronic lichen planus, sed areas of infiltrated reddened skin due to long-continued ching—*lichenification.* In eczema, psoriasis, and other forms

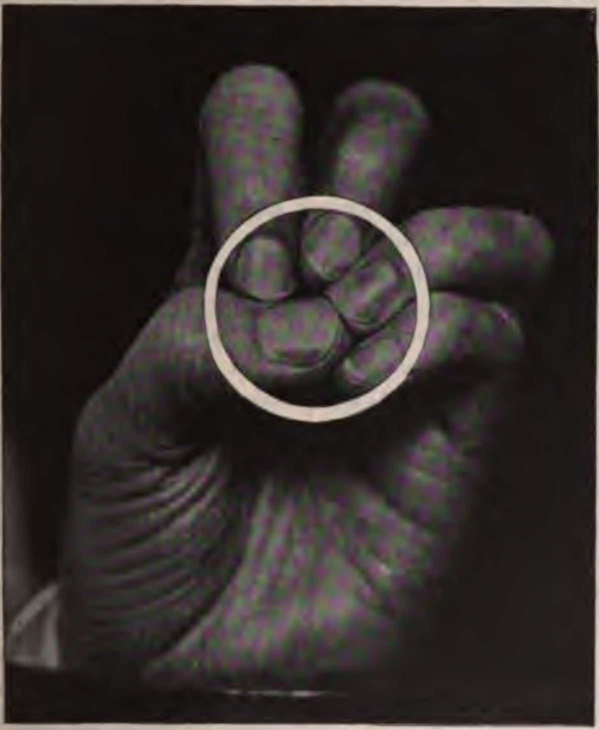


Fig. 4.—Position for the nails during application of X-rays.

flammatory dermatitis, when limited to chronic patches, X-rays an ideal treatment. These lesions melt away under pastille s at four weeks' interval. Itching ceases, and infiltration, red- and scaling disappear; and the treatment has the advantage ing clean and painless.

ronic Affections of the Nails.—Dystrophies of the nail ng from psoriasis, eczema, or ringworm are said by many to avourably affected by X-rays. The dose to be given is, as l, a Sabouraud pastille dose, which may be repeated once or times at intervals of one month. In order to include all the nails of one hand in one exposure, Sabouraud has devised a most ingenious plan, which is here explained by means of the photographer (Fig. 4). The most favourable cases for treatment by X-rays are those where the bed of the nail is attacked, as in many cases of psoriasis. No improvement is to be expected for some months; then the new nail will be seen growing up from the root and gradually replacing the old diseased nail. In ringworm of the nail, cures have been reported, but my own experience is not so favourable.

Lupus.—At one time much was hoped from the X-ray treatment in lupus vulgaris, and nearly every case of lupus was put under this treatment. But the results have been to a large extent disappointing. It still, indeed, remains a most valuable method for some forms of lupus, and a useful adjunct or preliminary to treatment by other methods in many cases, but it is by no means a specific cure for all cases of lupus.

The types of lupus in which X-rays do give good, and often brilliant, results are: (1) Verrucose or warty forms of lupus; (2) crusted or ulcerated lupus; and to these we may add (3) elephantiasic swellings associated with lupus or other forms of tuberculosis of the skin; (4) scrofuloderma.

Lupus Verrucosus—This type of lupus, which is generally met with on the backs of the hands, and which is characterised by an abundant warty growth of the epidermis in addition to the more deeply seated tuberculous infiltration, is particularly amenable to X-ray treatment. Exposures of pastille doses at intervals of three to four weeks are given, the exposure being carefully limited to the diseased area.

Lupus which is Crusted and Ulcerated is also best treated by X-rays, at any rate as a preliminary treatment. The X-rays should be given in pastille doses and at fixed intervals. The ulceration rapidly heals and the crusts fall off, and in many cases nothing is left eventually but a fine supple scar, and this without ever having exceeded the normal dose; that is to say, without having produced an X-ray dermatitis. In some cases lupus nodules will remain after the ulceration and crusting is cleared up; and these are then treated by selective caustics or by Finsen light.

Scrofuloderma.—The lesions known by this name, although undoubtedly tuberculous, do not present the typical apple-jelly nodules of lupus vulgaris. The infiltration is softer and shows more tendency to break down, and it occurs often in association with deep-seated tubercle of glands or bone. These lesions do remarkably well with X-ray applications, and are some of the most satisfactory cases for X-ray therapeutics.

Elephantiasis with Tuberculosis of the Skin.—As is well known, a general swelling of the tissues is not uncommon in association with lupus or scrofuloderma; whether it is wholly due to tuberculous lymphangitis or to secondary infection by other microorganisms need not be discussed here. A common form is the swelling of the upper lip and nose which is seen with lupus of the lip or nose. X-ray applications will generally reduce this elephantiasic swelling, so that attention can then be concentrated on the lupus in the skin.

Lupus Vulgaris of the ordinary apple-jelly nodule type, that is to say, uncomplicated lupus vulgaris, is not to be treated by X-rays. It is possible, as was formerly done, to destroy a lupus patch by replacing it by an X-ray scar, the result of an X-ray burn; but since we know that an X-ray scar is one which is liable to become telangiectatic, to break down readily, even to become the seat of malignant epithelioma, this is not justifiable. Moreover, lupus nodules are often left in the X-ray scars.

The position of X-ray Therapeutics in Lupus, in relation to other forms of treatment, may be indicated as follows:

I. *Excision.*—The ideal treatment for small patches.
II. *Finsen Light.*—For patches upon the face which are too large for excision without grafting, or which are so situated that they cannot well be excised as on the nose, lips or lobe of the ear.
III. *X-rays.*—For lupus verrucosus, ulcerated and encrusted lupus, and for scrofuloderma and elephantiasic conditions.
IV. *Selective Caustics.*—Salicylic acid plaster mulls, or pyrogallic acid ointments or mulls, for patches not crusted or ulcerated, and too large for excision.
V. *Tuberculin Injections.*—For lupus of mucous membranes, scrofuloderma, elephantiasic conditions, or as an aid to other treatments.

(3) MODIFICATION OF SKIN FUNCTIONS BY X-RAYS.

In the third group of cases we aim, not at the destruction of some morbid growth or the removal of a chronic inflammatory exudation, but at the modification of one or other of the physiological functions of the skin—of the sebaceous gland secretion, of sweat production, of the growth of hair, or of the functions of the sensory nerve endings. The cells of the sweat glands, of the sebaceous glands, of the hair bulbs and papillæ, and of the nerve terminals are more sensitive to the action of the X-rays than are the cells of the derma and of the epidermis. By giving just the right dose of X-rays we can influence these cells without damaging the surrounding tissues. For example, we can destroy the delicate cells of the hair bulb, and so cause fall of hair, without damaging the skin; and we can do this without permanent loss of hair, if our dose is so adjusted that it does not totally destroy the hair-follicle or the basal cells of the epidermis from which the new hair-follicle is subsequently developed.

Ringworm.—X-rays are now extensively employed in the treatment of ringworm of the scalp. The method was first used on a large scale by Sabouraud in Paris, who made it practicable by the introduction of the platino-cyanide of barium pastille as a means of accurate measurement of dosage. The treatment is now carried out in most of the large hospitals in this country; and in the Metropolitan Asylums Board Schools for Ringworm at Sutton, in Surrey, over 3,000 cases have been so treated during the past few years. A good deal has been written about the supposed danger of injury to the brain from exposure of the scalp to X-rays, but there is no evidence whatever that such has ever occurred, and it has been demonstrated by several observers that the skull-cap and skin are more than sufficient protection to the brain. The real danger from X-ray treatment of ringworm is that areas of permanent baldness may result; but the method of treatment is so far perfected at the present time that the risk in this direction is reduced to a minimum. What risk there is is due, not to any inaccuracy of the means of measurement employed, but to the fact that there is a personal element in the proceeding; in other words, there is the risk of an error of technique on the part of the operator. The operator is much in the position of a chemist dispensing a poisonous drug: there is always the risk of a mistake in the dosage, but in trained hands this risk is very small indeed. That accidents have occurred cannot be denied; but while the method is becoming more and more used, accidents are becoming more and more rare.

The X-rays are employed in the treatment of ringworm solely on account of their power of producing temporary fall of hair. The rays do not kill the fungus, but simply remove the hair upon which it lives. The X-rays do not select the diseased hairs, but the whole of the hair over the part exposed to them falls out.

The reason that the older methods of treatment generally fail to cure ringworm of the scalp is that no antiseptic application can be made to penetrate sufficiently deeply into the hair-follicle to destroy the fungus. When such measures are occasionally successful, they are so because they inflame the ringworm patches and thus lead to falling of the hair. But this inflammation of the patches can only be got in a small proportion of cases. The X-rays, on the other hand, produce temporary depilation with certainty, and without pain or inflammation.

The statistics of the Metropolitan Asylums Board Ringworm Schools are interesting for a comparison of the two methods. Before the introduction of X-ray treatment the average stay of the children in the home was nineteen months, although these children were having expert treatment. Since the introduction of the X-rays the average stay has dropped to two and a-half months.

Single Patches.—If there is only a limited number of ringworm patches, each patch may be treated separately by exposure through a lead-glass cylindrical localiser. A single pastille dose is given to each patch. No change is observed for two weeks. Then the hair, healthy and diseased, falls off the patch, leaving it quite bald (Fig. 5). The patch remains bald for from six to eight weeks, and then new hair begins to grow. Provided no ringworm patches have been discovered on the scalp in the meanwhile, the child is free from infection as soon as all the hair has fallen from the parts exposed, that is to say, in about one month after the exposure.

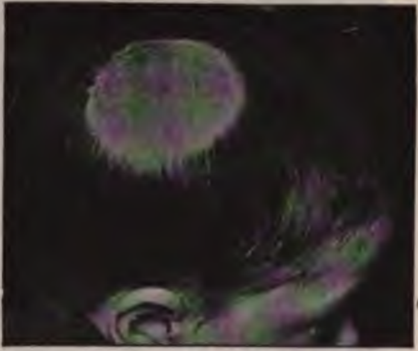


FIG. 5.—Bald patch after exposure of a single area in the treatment of ringworm.

Whole Head.—In very many cases, however, it is advisable to X-ray the whole head, and this should be done where the disease is at all extensive, rather than attempt to pick out the patches.

By the older methods from six to eight exposures at different parts of the scalp were required in order to depilate the whole scalp. The hair having been cut short, the scalp was marked out into rectangular areas, and each area was exposed to the rays in turn, taking care to cover up the adjacent areas very carefully with lead-foil, so as to get no over-lapping of doses.

A more simple and more rapid method, which is becoming generally adopted, is that which was introduced by the writer early in 1909, and which is now known as the "five-exposure method." The method is adapted from that employed by Kienboch in Vienna in the treatment of favus, and consists in exposing the scalp to a number of doses of X-rays, aimed in such directions that, although there is over-lapping of dosage, the over-lapping is so arranged that the whole scalp gets a uniform amount of rays. The whol operation is carried out at one séance, and occupies from on

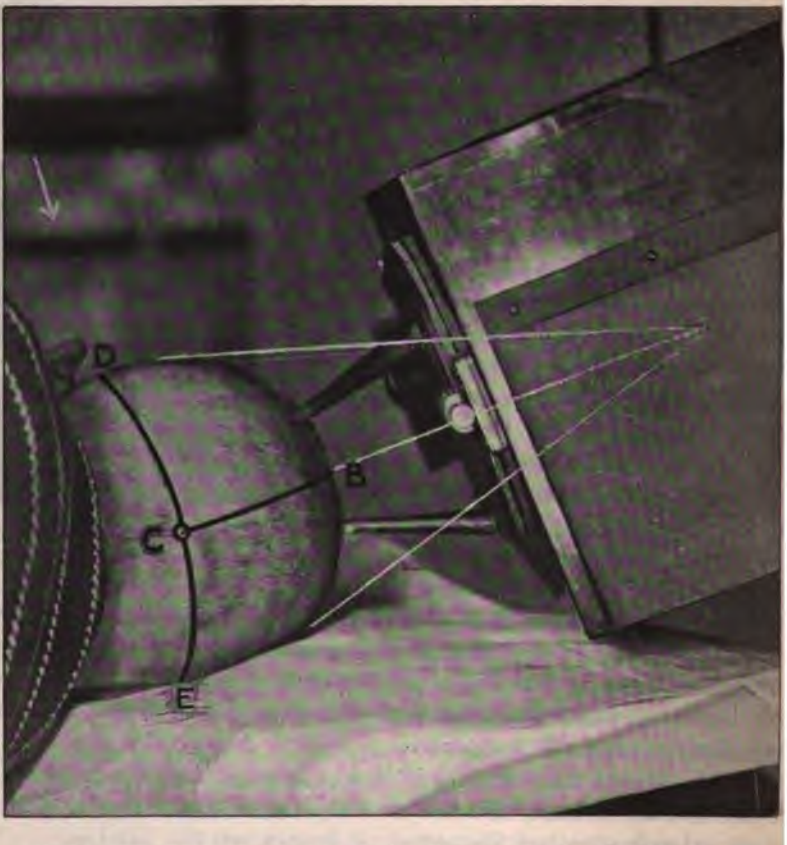


FIG. 6.—Showing head in position during X-ray applications for ringworm.

and a-half to two hours. During the third week from th séance the hair falls, and by the end of the fourth week the sca should be completely bald. The child is then free from infectio The new hair begins to grow about the eighth week from the fa and becomes thickly grown after some months.

The details of the method as employed by the writer are a follows:

(1) The hair is clipped short over the whole head to facilitate operations.

(2) Five points are marked on the scalp with a blue skin-pencil as follows (Figs. 6 and 7):

In the middle line
Point A—1 to 2 inches behind the frontal margin of the hairy scalp.
„ B—1 inch to 1½ inches above the centre of the flat area which forms the upper part of the occiput.
„ C—Just above the lower border of the scalp at the lower part of the occiput.

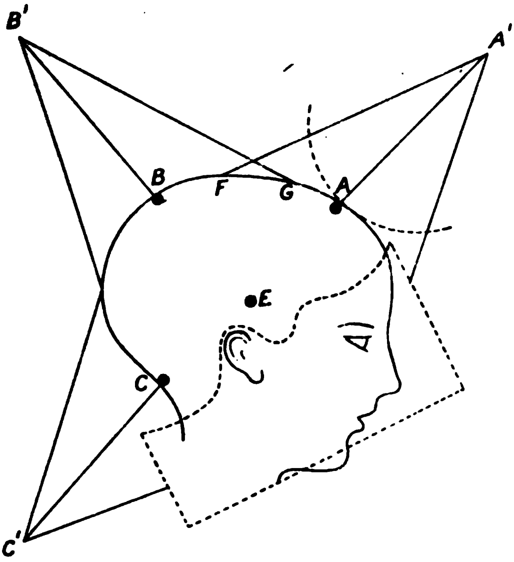


Fig. 7.—Diagram showing direction of doses in the application of the "5-exposure method" for treatment of the whole scalp.

At the sides of the scalp
Point D—On the right side, just above and in front of the ear.
„ E—On the left side, just above and in front of the ear.

Measured with a tape-measure the distance between any two of these five points should be exactly 5 inches.

(3) The five points are joined up by lines made with a skin-pencil. These lines should meet one another at right angles. The mapping out of these points and lines need not occupy more than one or two minutes.

(4) A Sabouraud pastille dose with the anti-kathode at 6 inches from the nearest point of the scalp is given to the vertex,

occiput, lower occiput, right side and left side in succession, taking the points A, B, C, D, and E as the centre of each area to be rayed, and placing the tube so that the line joining the anti-kathode (source of the rays) and the nearest point on the scalp is at right angles to a similar line joining the anti-kathode with each of the central points of the adjacent areas. The lines which have been drawn on the scalp connecting the five points give an indication of the direction in which the dose is to be aimed—*i.e.*, of the position of the tube in relation to the head. The applications are best made with the patient lying on a couch. The forehead and eyes must be shielded by a piece of lead or protective rubber during the exposure to the front of the vertex, and the ears and sides of the face when the sides of the head are exposed, and the neck during the fifth exposure.

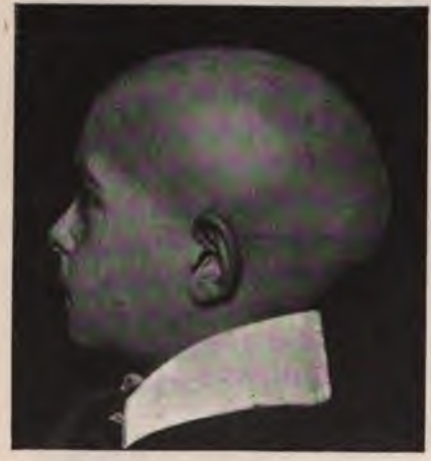


FIG. 8.—Scalp completely bald (temporary baldness) after treatment by the "5-exposure method."

The scalp is kept at the correct distance from the tube by means of three slender wooden pegs, which converge at their extremities to within 1¼ inches of each other, and which are of such a length that the part of the scalp which rests against them is just 6½ inches from the anti-kathode of the tube. The pegs are made of soft wood so as not to obstruct the passage of the rays through them. The pegs rest against the scalp just over the blue marks A, B, C, D, and E, according to the area to be rayed. The aperture in the box through which the rays pass is 3 inches in diameter and 3¼ inches from the anti-kathode, so that at the level of the points of the pegs the rays diverge to a circle of 6 inches diameter, and in this way one avoids the escape of rays into the room or towards the operator or on to the patient's shoulders, for a circle of this diameter is blocked by the patient's head. At the same time this circle of irradiation allows a good margin for the necessary over-lapping of the doses.

The essential features in this method are to aim each dose *at right angles* to the direction of the adjacent doses and to keep the five points aimed at 5 inches apart. If these precautions are taken there is no risk of over-exposure at the overlapping margins of the rayed areas. In practice the dosage works out so nicely that every part receives an equal amount, and depilation is total and complete, without anywhere a sign of over- or under-pressure.

After the X-ray exposures the scalp (Fig. 8) should be washed daily with soap and water and either a lotion of 1 part of tinct. iodi. to 7 parts methylated spirit applied daily, or else the head anointed with ung. hydrarg. ammon. chlor. (gr. 15, ad ℥j). These precautions are to disinfect the skin and loose stumps, and so prevent reinfection and the spreading of the disease to others. The child should wear a linen cap or bonnet, which must be changed every day. The hair begins to fall during the third week from the exposures, and at the end of one month the scalp should be completely bald. The child is then free from infection, and in two months from the date of the applications the new hair begins to grow, though the head will not be thickly covered until some weeks later.

Hyperidrosis.—The action of the X-rays upon the cells of the sweat glands is made use of in the treatment of hyperidrosis. Sweating of the hands and of the axillæ may be cured by exposure of the parts to the X-rays. A full-measured pastille dose is given, followed usually by another at an interval of not less than one month, and by a third dose if required. The results are very satisfactory and apparently permanent. Lately, good results have been reported in that curious affection of childhood known as granulosis rubra nasi, in which there is hyperidrosis localised to the skin of the nose, and associated with redness and some inflammatory infiltration.

Seborrhœa.—Oily seborrhœa, such as accompanies acne vulgaris, is much benefited by X-ray applications.

Pruritus.—In localised forms of pruritus, associated or not with skin affections, X-ray treatment is of very great value. Its influence in at once stopping the itching in cases of lichenification, in chronic eczema, and in lichen planus is remarkable. It is also very useful in obstinate cases of pruritus ani or pruritus vulvæ. After one or several doses, generally rather less than pastille doses when a part bordering on the mucous membrane is exposed, the pruritus commonly ceases, and the cure is often permanent.

H. G. ADAMSON.

REFERENCE.

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X-RAY TREATMENT OF DISEASES OTHER THA SKIN DISEASES.

THE treatment of diseases involving the more deeply situat tissues by exposure to the radiations emanating from the X-r tube must be considered as a separate and distinct branch X-ray therapeutics, because the mode of procedure employed, a the physical principles involved in securing effective irradiati of these parts are entirely different from those encountered in t treatment of diseases of the skin itself.

Indeed, the greatest difficulty met with is the prevention of t effects of these radiations upon the skin. Constant or inte exposure of the skin to the influence of X-rays is followed by inflammatory reaction, which exhibits the characteristics of ordinary burn caused by the direct application of heat, but wh differs from that condition in that the changes in the skin app only after a most marked latent period; further, when o these changes have been developed they are most intractal liable to become chronic, are usually followed by scarring, and not uncommonly associated with telangiectasis. The devel ment of this skin reaction in the early days of X-ray treatm interfered with, and in fact almost precluded, the possibility irradiating the deeper parts, for, owing to the then want of kn ledge, numerous accidents were reported, in which, while attem ing to influence diseases in the deeper tissues, the skin was entir destroyed; chronic ulcers were thus formed, and perman scarring with telangiectasis resulted. It is now known that fr the X-ray tube emanate radiations possessing different powers penetration. Thus, while part of the radiation has the power penetrating the whole thickness of the body, another is entir absorbed by the superficial layers of the skin. Professor Sir J Thompson has stated that in the case of the lower penetrat radiations total absorption by the skin takes place at a depth less than a millimètre, and he was strongly of the opinion that absorption of this radiation explained the troublesome dangerous reaction which followed prolonged or intense expos to X-rays. This observation is of the utmost importance in treatment of the diseases under consideration, for it would app that if any substance is placed between the X-ray tube and skin which is of a sufficient density to absorb the lower penetrative radiations, the skin reaction would be abolished. In practice such protective methods have been tried and found to be successful. Any substance such as wash-leather, specially prepared screens of calcium tungstate, or calculated thicknesses of aluminium have been successfully employed for this purpose. The author has been in the habit of using for some years, as an effective means of protecting the skin, a very simple arrangement, namely, several layers of ordinary table-felt, which in all make a thickness of material of not less than 1 inch between the tube and the skin. Any of these protective methods have for their object the absorption of the lower penetrative radiations before they reach the skin, and thèy have been called "filters" for this reason. To be efficacious they should not interfere to any appreciable extent with the free passage of the higher penetrative radiations. In the treatment of the more deeply situated diseases it is the higher penetrative radiations which are employed. Although the advisability of cutting off the lower penetrative radiations (by the use of a filter of some kind) in the treatment of all diseases may be open to criticism, yet in the case of the deep-seated affections the undoubted influence the higher penetrative radiations exert, as, for example, on the myelocytes in spleno-medullary leukæmia, together with the fact that little or no skin reaction follows, amply justifies their exclusive employment. In order that successful results may be obtained from the use of X-rays, especially in the treatment of the diseases under consideration, it is necessary that the apparatus employed should be effective. It has been found necessary in securing X-ray shadows of the deeper parts of the body to increase the power of the electrical excitation of the X-ray tube, and so, in therapeutic irradiation of the deeper tissues, powerful excitation of the tube must also be employed. It is highly desirable that some method of measurement should be devised so that a definite statement can be made as to the dose to be employed, but unfortunately this at present is not possible. In the case of the exposure of the skin only, Sabouraud's method of measurement is made use of, but in the treatment of the diseases under consideration we have introduced foreign elements which make this otherwise most useful method of no value. With the use of a filter we may disregard the action of the radiation on the skin; indeed, we are desirous of far exceeding any such limits, and can do so as far as the skin is concerned without fear of producing harmful results. The amount of high penetrative radiations capable of production is, as a matter of fact, limited by the X-ray tube itself, at least as it is at present constituted, for if powerful electrical stimulation is employed it is only for a limited time that even the most effective tube will continue to produce X-rays. The amount of radiation possible is further limited, in that, although the use of a filter prevents any inflammatory reaction on the skin, yet some reaction may develop if exposures are given frequently and are intense. This reaction, however, may be disregarded, for it soon disappears on discontinuance of the exposures or reduction in their intensity or duration.

The cardinal points to be attended to in the successful irradiation of the deeper tissues for therapeutic purposes may be very shortly put as follows :

(1) The use of a good X-ray tube, that is, a fresh one, possessing a water-cooled or air-cooled anode, and capable of producing X-rays for five to eight minutes with 5 milliampères of current passing through it.

(2) The use of an induction coil or other electrical apparatus of sufficient power to pass through a tube of not less than a 4-inch equivalent spark a minimum amount of current of 5 ma.

(3) The use of a filter of some kind.

(4) Effective protective measures for operator and patient.

(5) A minimum distance of 8 inches to be maintained between the X-ray tube and the skin.

Many other points connected with the treatment are encountered, but they are mostly of a technical nature and cannot be dealt with here. With regard to the diseases in which beneficial results may be obtained by this method of treatment, it may be said at once that it is very difficult to make a definite statement. The method is still somewhat new and untried, and absolute proofs of its efficacy are often wanting. The results obtained are, however, in certain cases very encouraging, and if later the mode of action of the radiation should be discovered, still better results may be expected.

First in regard to the treatment of malignant disease, using the term "malignant disease" in its widest sense. Not very long after X-rays were discovered their beneficial effects upon rodent ulcer were reported. Since that time it has been used in the treatment of malignant disease of other parts of th body, and numerous cases are known, in which even a absolute cure was claimed. On all sides it is admitted tha X-ray exposure may delay the encroachment, or even lead to th temporary disappearance, of a malignant growth, yet it must n be said that a cure is possible by their unaided action. Admitting, however, that sufficient proof of the inhibitory influence of the radiation is now in our possession, it can be stated that such treatment combined with proper operative procedure is of the utmost importance. For example, in the case of such an accessible part as the breast, recurrent growths after operation are often influenced by the X-rays. This being so, it is surely much better to commence X-ray exposure immediately after operation, and not wait for recurrence to show itself. This idea may be taken still further, and the treatment carried out without harmful effects at the actual time of operation, before the skin flaps have been replaced over the operation area. In this way new growth cells which may have been left in the depths or scattered over the raw surfaces, by the operative measures of the surgeon, are destroyed and the best results secured by combining the undoubted inhibitory effects of X-ray exposure with operative procedure. The writer has treated several cases in this way; but although the results are so far encouraging, it is too early to speak with any certainty regarding the ultimate effect of such treatment.

In conclusion, the writer thinks it will be conceded by all who have had experience of X-ray exposure in malignant disease that such treatment in seemingly hopeless cases occasionally produces rapid and marked improvement, both as regards the local condition and also the general health of the patient. On the other hand, cases are frequently met with in which X-ray exposure is of little or no use. No harmful result, however, is to be feared from the exposures, and the treatment can be carried out easily without interfering with the patient's comfort. Therefore it is to be strongly advocated in cases in which (1) operation is not possible; (2) the involvement of important structures renders the total removal of the disease improbable; (3) operation has resulted in a recurrence.

On no account should this treatment be allowed to interfere with proper surgical methods; but, as already stated, it is best used in conjunction with them. Where diseases involve structures such as the brain, lungs or abdominal organs, no good results may be hoped for.

X-ray exposure of the spleen in the case of spleno-medullary leukæmia produces a most remarkable change in the condition of the blood: the myelocytes are reduced in number and may even disappear. There is not the slightest doubt attached to this observation, for numerous cases have been reported in which the utmost care has been taken to prevent any false conclusion, and in all of them the X-ray exposure gave the same results. In this country the first case which was reported was by Ledingham and McKerron,[1] and many others followed. In two cases reported by the writer,[2] a filter was made use of to protect the skin, and in both satisfactory reduction of the myelocytes followed as usual, a fact which is of great importance, in that it proves the higher penetrative radiations from the X-ray tube (which in these two cases were made use of alone) to be the active ones in influencing the myelocytes in spleno-medullary leukæmia. In this grave disease the most remarkable improvement takes place in the general condition of the patient. The abnormal temperature disappears, the strength and appetite return, the colour improves, the spleen diminishes in size, and not infrequently the patient shows every sign of returning to his normal condition. This effect can be produced with certainty in every case; but the difficulty is that, although in this way the disease may be controlled, it cannot be eradicated. If by X-ray exposure the blood becomes practically normal within a certain period of time, which varies in different persons, the abnormalities of the blood appear again, and if exposure is not once more carried out the condition of the patient reverts to what it was formerly. More or less constant X-ray exposure is, therefore, necessary to control the disease, and while in some cases such exposures should be carried out frequently, in others but few are necessary. Under such circumstances these cases always end fatally, and the time which they last seems to be exceedingly variable. Roughly, it may be said that the younger the subject the longer the beneficial results of the exposures may be maintained. A most wonderful improvement may, therefore, be expected from X-rays in this disease, but it is exceedingly disappointing as far as a cure is concerned. When it is recalled, however, that this disease has always been regarded as a fatal one, the treatment must be looked upon as partially successful, for with such measures it is possible to give some months, if not years, of comparatively good health. Occasionally improvement has been obtained by other means, but instances are rare, whereas X-ray exposure in genuine spleno-medullary leukæmia will certainly control the disease. Here again, as in other conditions, once the effect of the X-rays is assured, every effort should be made to delay as long as possible the recurrence of symptoms by such other measures as are available.

The prognosis in these cases should be a most guarded on for the patient may entirely recover at first, and lead one to suppose that the disease had been eradicated; yet without warning it may recur with an acute onset, and prove to be quite uncontrolled by X-ray exposure and lead to death. The answer to the question, should X-rays be employed in the treatment of this disease, must be dependent upon circumstances, for if they are adopted the case will go on nevertheless to a fatal termination. On the other hand, the distressing condition into which the patient sinks, and remains for some considerable time, may be avoided, and in some cases strength and a surprising degree of good health may be secured for a variable time. At any rate, the final stage, when it does appear, will probably be less protracted.

When X-ray treatment is made use of in this disease the number of exposures necessary to control the condition of the blood is easily and accurately ascertained by a periodic estimation of the relative numbers of the blood corpuscles. The general condition of the patient, however, ought also to be considered: thus, should the blood show large increases in the number of myelocytes, and yet the general condition remains good, there is no reason to push the treatment unduly. It is very difficult to make a definite statement as to the exact number of white corpuscles that should be aimed at. The writer has in these cases attempted to keep the number of white corpuscles below 40,000 per cubic millimetre, and he has found this point a satisfactory one, so far as the general condition of the patient is concerned. It ought to be remembered during the process of reduction of the number of white corpuscles that the count will fall after the exposures have been stopped: thus, if the white count has been reduced to 40,000 per cubic millimètre, and treatment is suspended, the effect of the X-rays will continue, and a further reduction, which may be large or small, will take place. It is best, therefore, to exercise extreme care in the matter of exposures when the white count falls as far as 40,000.

There have been various assertions made regarding the best *site for the application* of the radiation; but so far as the author's experience goes, exposure of the spleen only seems to be quite effective. It is usually advised that the ends of the long bones be also treated, together with the sternum and vertebræ. At first three exposures a week, of the extent of intensity already referred to, can be employed, but later with the fall in the number of the myelocytes a considerable reduction can be made. Once the disease is under control by periodic observation of the white corpuscle count it is possible to arrive at the minimal amount of X-ray exposure that will keep the white corpuscles down the requisite number.

Kocher has suggested irradiation in treatment of the exo thalmic goître. Successful cases have been reported, and t method of dealing with the disease seems to have been sa factory in the hands of most experts. The writer has trea a number of cases, and from observation of them is also convin of the beneficial effects of this treatment. The procedure such cases is as in other diseases : the maximum exposure be given at least once, perhaps twice, or even three times a we according to the severity of the symptoms. The improvem produced is very slow and the whole process very tedious. T skin has to be most carefully watched, and any sign of redn is an indication for reduction of the number of exposures cessation in the treatment for a time. There first appe some improvement in the general condition of the patie but the enlargement of the gland, should it be present, and exophthalmos remain unaltered. Continuation of the exposu results in the patient gaining weight, the pulse becoming mu slower and fuller, but still no great change in the condition of eye or the thyroid gland is effected. In one case under writer's observation in which X-ray exposure was continued over twelve months, the pulse became abnormally slow, and patient showed a very striking increase in weight. In fa symptoms to some extent resembling those of myxœdema beca apparent. The difficulty the writer has met with in the tre ment of this disease is that of getting patients to attend regula for the long period necessary, namely, six, nine, or even twe months ; but in all the cases that have come under his care, which regular treatment was possible, some improvement w observed, especially in those where enlargement of thyroid gla existed.

With regard to the prognosis, it is difficult to make any positi assertion, but it would seem to be hopeful in cases in whi improvement in the general condition occurs early. As in ot diseases, the combination of surgical measures and the control X-ray exposure appears to be desirable, for if the general con tion of the patient makes surgical treatment inadvisable, t method is likely within a reasonable time to effect such a chan in the general condition as would make the removal of the gla possible.

In myoma of the uterus associated with metrorrhagia, X-r exposure of the uterus produces reduction in the size of the tumo and controls the loss of blood.[3] The effect of such treatment is somewhat remarkable, in that a beneficial result is developed more or less suddenly after several exposures, and it has been suggested that some influence over the ovaries is effected which produces changes in the behaviour of the uterus similar to those which occur at the menopause, and are well known to cause reduction of such tumours. Whatever be the theory of the action of the X-rays in this disease, the effect they produce is most satisfactory. In suitable cases, therefore, the treatment may be used to alleviate the symptoms, but it is not possible, since the use of X-rays in this connection is comparatively new, to make any statement with regard to the ultimate effects of the treatment. So far as one can tell, no harmful result is at all likely to be produced by such exposure, except perhaps the possible sterilisation of the patient, which, however, should not be a permanent effect. The method of procedure is the same as in other conditions: a filter should be used and the body of the subject suitably protected, except over the area corresponding to the uterus. The direction in which irradiation should be carried out depends upon the position of the tumour, whether towards the cervix or in the region of the fundus of the uterus. If the former from below upwards, if the latter from above downwards. In other cases the direction of the radiation should be in the axis of the brim of the pelvis, and in carrying out exposures from below upwards the left lateral position with the knees well drawn up will be found best for the purpose.

X-ray exposure in simple enlargement of the prostate gland has been reported to produce beneficial results, and in the writer's hands in some cases it appears to have been of value, while in others no effect whatever was produced. Under these circumstances, in cases of prostatic enlargement which have been found unsuitable for operative procedure, irradiation might be tried, and here, again, this method has the advantage of being exceedingly easily carried out and inducing no harmful result. The method of procedure need not be elaborate; the patient should be placed in the left lateral position with the knees well drawn up, the rays being directed from below upwards.

Tuberculous glands, provided they have not broken down, when exposed to X-rays have been found to be greatly benefited. The curative effect is somewhat slow in development and tedious to produce, for as long a time as three to six months may elapse before the glands disappear.[4]

Only in specially selected cases should such treatment be adopted, and the one danger to be feared is the production of permanent changes in the skin from so long exposure, though by the use of a filter the possibility of producing such is somewhat remote. Where tuberculous glands have broken down, suppurated or have been surgically dealt with, and there remain tuberculous sinuses which refuse to yield to the usual treatment, most beneficial results can be obtained. In such cases the sinuses heal, and the scar tissue which has been formed becomes soft and pliable. The procedure in both the above conditions presents no special difficulties, and it should be carried out as already described.

X-ray exposure is reported to have produced beneficial effects in other diseases, among which may be mentioned, the enlarged spleen of malaria, Hodgkin's disease (lymphadenoma), rheumatoid arthritis.

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THE ZANDER TREATMENT.

view of the widespread reputation which this treatment has
ied abroad, and the frequent references to it in medical
ature here, it seems strange that it is still relatively unknown
England. At the present time there is only one technically
plete Zander institute in London, whereas in Sweden, Ger-
y and France we find that not only all the larger towns and
lth resorts have such installations, but also most of the modern
pitals.

s long ago as 1857 Dr. Gust. Zander, a Swedish physician,
ceived the idea of using mechanical power to carry out that
tem of exercise (previously introduced by Ling in Sweden)
own as the manual method, so called because a trained atten-
nt is needed for its proper administration. His method, how-
r, encountered the greatest opposition for many years, and so
at was the antipathy and conservatism shown by medical men
regard to physical methods that it was not till 1880 when
Nebel[1] and others succeeded in popularising it and making
advantages appreciated by the medical profession. The sub-
ution of mechanical power for that of the hand at once widened
sphere of usefulness, so that quite a new system of physical
apeutics was evolved, which had many advantages over other
hods of exercises. The fact that medical supervision of these
hanical installations was insisted on by Dr. Zander has also
n greatly appreciated by the profession abroad as a potent
or in keeping this branch of physical therapy out of the hands
uacks.

ing's system of gymnastics consists of active exercises, carried
by the patient's own efforts and passive exercises, which are
lied by an attendant, without any exertion on the part of the
ent himself. The active exercises become and are called
stance exercises if the efforts of the patient to contract his
cles are opposed by the attendant gymnast, so as to put
e strain or work on the patient.

r. Zander's machines now do the work of the attendant
nast, and are constructed in such a way that the various joints
limbs can be exercised, whilst the patient himself remains in
mfortable position all the while. Those for active movements

are so designed that, by the aid of graduated levers and sliding weights, any desired resistance from zero to the maximum can be obtained; while those intended for passive exercise are worked by motor power, and can be equally well adjusted and graduated both in regard to speed and range of movement.

Some of the passive machines are meant for producing rotary movements of the body in different planes, moving on horseback, breathing exercises, pendulum movements of the joints, etc., while others are designed for mechanical operations, such as friction, percussion, vibration, etc. These latter represent a useful and interesting component of the treatment, which, though not actually replacing manual massage, is very effective in many cases and quite unique in its action.

The machines for resistance exercises not only allow the regulation of this resistance as necessitated by the normal development of muscle and the different strength of different individuals, but they also comply with the physiological law of muscle contraction: the resistance increases in the beginning of each muscular contraction and diminishes towards the end. In this important respect the Zander appliances differ from other machines, which do not vary the resistance through the course of each muscular contraction.

As both the amount or weight of resistance and the range of movement are indicated by the machine, the physician knows at once the actual exertion of the patient as well as the increase in the flexibility of the joint, and can thus easily control each case, and thereby avoid over-exertion. Another advantage of this system, as regards general exercise, is that the benefit of exercise can be extended over the whole muscular system, and is not necessarily limited as in most athletic pastimes to certain sets of muscles only.

The Zander system as a dietetic measure must, therefore, appeal to all who by choice or necessity lead a sedentary life, yet want to avoid the injurious effect of this. Even those who regularly indulge in exercise of one kind or another can advantageously supplement such by this system, and thus develop the muscular system more uniformly.

To invalids who have no prospect of a permanent cure it offers an opportunity of healthy exercise which they cannot obtain as easily in any other way, and for children and adults who are delicate or narrow-chested, or in any other way debilitated, it is by far the most effective way for the systematic development of the muscular system and the expansion of the chest.

In its strictly therapeutic aspects, the Zander method is beneficially employed in many constitutional ailments, such as gout, diabetes, rheumatism, asthma, obesity, etc.

The curative action is, however, mainly due to the dynamic effect of muscular contraction and respiratory movements on the circulation and the heart; and for this reason the Zander treatment has most beneficial results in the various disorders of the circulation, and in those cases (and there are many) in which a cure or improvement can be realised by improved conditions of the circulation.

The increased flow of blood and lymph through its tissues which accompanies every muscle contraction, and the physiological fact that the muscles after exercise increase in volume, by drawing more blood to themselves, are important factors in regard to the circulation. They show that by systematic exercises not only the general circulation can be improved, but that the distribution of the blood in various parts of the body can be controlled to a certain extent in order to relieve congestion of internal organs and undue cardiac pressure or strain. Here the Zander method of exercise has its distinct advantages, as by means of resistance exercises the contractions and relaxations of the muscles are carried out more thoroughly and effectively than in ordinary exercise, and it enables us to bring into play the whole muscular system or single parts thereof, as we choose. We can thus act with great effect on the general circulation, or on local conditions, according to the requirements of each case.

Dr. Heiligenthal,[2] of Baden Baden, has recorded the cases frequenting the Grand-Ducal Zander Institute (from 1887 to 1892) on account of diseases of circulation. He tabulates them as follows:

Debility of the heart	277
Fatty degeneration or tendency thereto	158
Valvular lesions	142
"Nervous" heart troubles (palpitations)	45
Aortic aneurysms	5
Angina pectoris	10
Arterio-sclerosis	31

The results, he says, have been generally favourable, and in some cases surprisingly so.

In cases of dilated heart due to over-exertion or prolonged increase of blood-pressure, or arising from abuse of alcohol or tobacco, a course of Zander treatment regulates the distribution of the blood, and tends thereby to reduce the blood-pressure to its normal condition. Valvular diseases of the heart are also mostly favourable for this treatment. Although, of course, a perfect cure is out of the question, yet the improvement in the subjective conditions of the patient, consequent on the restored compensation, is often so great as to make him entirely forget or ignore his complaint.

The various disorders of the digestive organs and the prevalence of chronic constipation afford many indications and opportunities for mechano-therapy. In cases of dyspepsia or constipation we can with great benefit have recourse to massage, but when these troubles, especially the latter, are due (as is commonly the case) to an atonic condition of the abdominal wall or of the general muscular system, then we cannot expect much from massage alone. Here the Zander method is as useful as it is convenient, in that it provides a great variety of abdominal exercises, such as horse-riding, rotations of the body on different planes, various movements (forward, backward and lateral), all of which could hardly be obtained in any other way. Here, too, we call to our aid the mechanical operations of friction, percussion and vibration, which are useful for stimulating nervo-muscular action. When applied to the umbilical or lower lumbar region, they stimulate the non-striated muscles of the bowels and promote peristalsis.

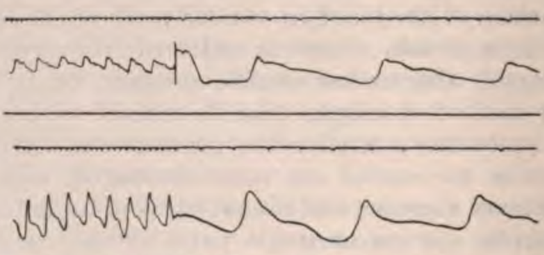

FIG. 1.—Pulse tracings, showing the effect of systematic exercises. The upper shows high tension and a feeble heart; the lower shows less tension and a stronger heart after a course of exercises.

The present system of education undoubtedly tends to produce in the young and rising generation a number of deformities, the commonest of which is the habitual scoliosis. In my experience this condition is much rarer in England than on the Continent, where the physical side of education is more neglected; but too much attention certainly cannot be given in school to the posture children assume and occupy whilst engaged in writing or other similar desk work, because we know that it is here the mischief usually begins. The spine naturally accommodates itself to the faulty position assumed, and soon this posture becomes habitual, especially when there is some predisposing cause. The acquired spinal curve soon exceeds physiological limits, and the different structures in turn adapt themselves to the new conditions by gradually giving way to the pressure on the concave side, while the structures on the convex side are stretched and enlarged. The weight of the body is thus no longer evenly balanced on the spine, but naturally leans more heavily to the concave side, thereby producing an increasing tendency to further scoliosis.

The Zander method of mechano-therapy meets this condition in two different ways. There is in the first place the, so to say, static treatment, by suspension of the body in certain positions, so as to tend to reverse the direction of the curvature, and by exercising those muscles which by their attachment to the spine produce a correcting effect, according to the physiological fact that a muscle, systematically exercised, shortens. Secondly, we have recourse to massage and general exercises of all the muscles of the back, so as to give them more tone and strength to support the spinal column.

Only the spinal curvatures without deformities of the vertebræ and cartilages can be considered perfectly curable by timely and suitable treatment of this kind, yet very great improvement results even in those cases where such deformities existed.

In functional derangements of joints following accidents the Zander method of treatment has a wide range of utility, and often restores the normal movements, which otherwise would remain greatly impaired. For this reason the machines for resistance movements for the different parts come into request, to restore the diminished or vanished muscular power, while the machines for passive or pendulum movements will come into use for gradually increasing the movements of the contracted joints. As a rule, patients resist any attempt at forcing a joint by the hand, for fear of being hurt by a sudden jerk or too much force; but they soon gain confidence in and co-operate with the uniform movements of the machine, which they know cannot suddenly increase the adjusted range of movement.

In addition to these two kinds of apparatus we have, as already referred to, mechanical vibrations, percussions, frictions, etc., whereby important effects can be obtained to loosen adhesions, stiff joints, etc. Vibrations in close contact with the body have a rather sedative effect, and are, therefore, useful in painful conditions; while those in interrupted contact (percussion) are stimulating in effect, and are employed to promote the local circulation and tone up the impaired muscular tissues.

The complications and sequelæ of fractures, of course supply the greatest number of joint troubles, contractures due to adhesions, matting together of the soft parts, or alteration of the surface of the joint. In addition to this source we have sprains, inflammation of tendons and sheaths, suppuration of cellular tissues, lesions of soft parts and various other injuries, all of which may result in functional derangement or impairment of mobility, conditions which are amenable to and greatly benefited by mechanical treatment. In such cases manual massage will be found a most valuable addition, and, indeed, indispensable, where we have to rid the deeper tissues of infiltration or extravasation.

Baedeker, the President of the Imperial Office of Insurance, stated in the 1899 Congress at Milan that in the year 1888, before the use of mechanical exercises in cases of accidents, the proportion of injured persons whose duration of treatment exceeded twenty weeks was more than 50 per cent., while in 1893 methanotherapy had reduced this to 2 per cent.

Insurance companies, trade associations, railways and large employers of labour on the Continent have recognised the economic value of the Zander method of treatment, and great firms like Krupp, in Essen, have their own large Zander institutes for their injured workmen. The first of its kind in England for the working classes is just completed in Sheffield and was given to the town by a philanthropic employer of labour, who himself has been benefited by the treatment abroad.

Only a few examples have been given of the many advantageous applications of the Zander method of mechano-therapy; but these few examples I hope sufficiently indicate the soundness of the principle which underlies this method. If its therapeutic efficacy were utilised more fully by the medical profession, it would lead to further investigations into its usefulness, and help to eliminate the element of quackery, which has always been mixed up, more particularly in England, with physical therapeutics.

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TROPICAL DISEASES.

PERSONAL AND GENERAL HYGIENE IN THE TROPICS.

FOR the European there are three essential conditions for the maintenance of health in the tropics. The first is that the individual must adapt himself to the climatic conditions; the second is that he must protect himself from the insect-borne diseases of the locality; and the third is that he must take precautions against insanitary conditions.

ADAPTATION TO CLIMATIC CONDITIONS.

Variety of Tropical Climates.—Climatic conditions gradually exercise an important influence on the constitution of Europeans, and this is effected, although these conditions vary much, according to the situation of the locality as regards the position of the sun, the distance from the Equator and sea, the elevation of the land, the amount of rainfall and the prevalence of the winds; for there is one factor always present, and it is the constant higher temperature ranging from 80° F. to 100° F. or more, which places those coming from a temperate zone in a totally different environment from that to which they have been accustomed.

The climate may be hot and dry or hot and humid. Islands and the coast usually possess a hot and humid climate with but little variation throughout the year. Many localities in the equatorial region do not vary more than 2° or 3° F. in temperature. On the other hand, away from the coast in the hinterland, which is generally higher, and in the interior of continents, the climate is usually hot and dry and may be subject to great diurnal and annual ranges of temperature. As a rule, heat combined with dryness is less oppressive and debilitating to Europeans and better borne by them than heat and moisture, which may be of a kind that reminds one of a Russian bath. The relative humidity of the air plays an important *rôle* in climatic effects in the tropics. It is a matter of experience that those localities which have a temperature of 86° to 90° F. accompanied by much humidity are the most exhausting.

Physiological Effect of Tropical Regions on Europeans.—Whether the climate is dry or moist the system of the European gradually undergoes certain functional changes which are efforts on the part of the body to adjust itself to the new conditions.

The most important of these changes is a greater supply of blood to the surface of the body and a greater activity of the functions of the skin, which by profuse perspiration counterbalances the additional external heat and keeps the body at the ordinary temperature. Whatever tends to retard, check or prevent this action of the skin is likely to cause disorder or disease. Persons who suffer in their sudorific system or from skin disease are not suitable subjects for the tropics. Besides the freer action of the skin, the functions of the liver, bowels and spleen are at first stimulated, but later there is a tendency to sluggishness and to more or less depression of the vital activities; thus, the pulse may be slowed, the heart action weakened, the powers of digestion enfeebled, the appetite lessened and nutrition lowered. The nervous system is also liable to become particularly susceptible to external and mental impressions readily losing tone, especially in those of a highly nervous temperament. Loss of control of the higher centres may result. Irritability of temper and of the nervous system generally is not an uncommon effect of residence in hot climates. Persons with an unstable nervous system are not fit subjects for the tropics.

Adaptation of Habits to Climate.—For the majority, however, no ill-effects are produced for many years on a sound constitution, if the spontaneous efforts of the system are seconded by adaptation of the habits of the individual to the climate. But it is this adaptation that is so frequently neglected, especially by a race new to tropical possessions. Europeans are apt to continue in the tropics the habits they are accustomed to in temperate regions, though experience has shown it to be dangerous. Much of the sickness and mortality of olden times was due to the non-recognition of this fact; many of the diseases of the liver, cases of heat-stroke and break-down in health were due to over-eating, over-drinking and exposure to the sun in unsuitable clothing. High living was considered necessary to counteract the debilitating effect of the climate, and this was done by eating the rich foods and drinking the strong wines of Europe. Matters have improved immensely in these respects, but even now new arrivals find difficulty in believing that special precautions are necessary. Of these precautions the most important are protection of the head, eyes and spine from the sun's rays during the hottest hours of the day, the wearing of light, loose and suitable clothing, avoidance of chill, the adoption of a simpler and less fatty diet and the leading of a more temperate and regular mode of life.

Precautions when Exposed to the Sun.—Undue exposure to the rays of a tropical sun unprotected is, under ordinary circumstances, dangerous for most people though under great excitement it may not be so. For instance, during the Indian mutiny the British troops were exposed in a manner which would have been fatal to them in times of peace. But this and other similar instances of the kind are exceptions. There are also individual exceptions. Occasionally one comes across men in the tropics who go about bareheaded without injury, who can break all the ordinary rules of health and who take no precautions, but their example is not to be followed.

There are some hot climates where sun-fever and sunstroke are unknown and where a headgear of special design is not worn, an ordinary single or double Terai hat being sufficient protection. But for all those tropical regions where the sun's atmospheric conditions are dangerous, exposure to the sun demands thorough and special protection of the head and eyes and for many persons protection of the spine as well.

Out of doors, during the great heat of the day, a light, well-ventilated red or yellow-lined solar helmet, affording shade to the eyes, temples and neck, should be worn; tinted glasses are pleasant for the eyes and relieve the discomfort caused by the glare as well as by the slanting rays of the sun in the morning and afternoon; and a yellow or red-lined umbrella gives additional protection. If cycling or riding, a spinal pad, orange in colour, fastened inside the coat or over the shirt, takes the place of the umbrella.

Dress.—Next to protection from the sun is the wearing of suitable clothing to secure coolness without risk of chill. The skin becomes particularly sensitive to exposure to wind and rain, and it s sometimes easier to catch a cold in the tropics than in more emperate regions, because in the latter more care is taken regarding lothing.

The material should be absorbent and yet not of a texture to ause chill. It should be porous. Linen is to be avoided. In imates where the diurnal range is great the finest woollen articles, hich should be loosely woven and loosely fitting, are the best. In ot, humid and equable climates wool may be irritating to the kin. Anglo-Indian gauze, which is a mixture of cotton and silk, r cotton in the form of cellular cloth, both of which are porous nd warm, may be worn. Yellow or orange-coloured shirts have been found useful against the actinic rays of the sun. A cholera belt to protect the loins and abdomen from chill should also be worn, but care has to be taken that it shall be so fixed to the day or night garments that it will remain in position. As long as care is taken with the garments worn next the skin the upper are of secondary importance, and may vary considerably both in colour and texture. Different coloured serges are probably the best. "Solaro" cloth, which is woven with yellow, blue and red threads, is very serviceable as a protection against the chemical rays. Heat is least absorbed by white or grey. In camping out and when travelling puttees are useful in protecting the legs from the bites of insects and snakes. They should, however, be worn with trousers. The wearing of drawers which do not cover the knee, along with puttees, so that the knee and a part of the thigh are exposed to the bites of mosquitoes, tsetze and other biting flies, is a dangerous practice.

After exercise it is essential to put on a sweater or extra wrap, or take a warm bath or get a rub down and a change of clothing. Clothes should also be thoroughly dried and aired before being put on, and this precaution is specially necessary during the rains. Damp or wet clothes should always be taken off, for if worn they are apt to produce internal congestions, or bring on fever if the individual is a malarious subject.

Food and Drink.—Reduction in the amount of the animal food and a more liberal allowance of vegetable food and fruits are the principles to be followed in the tropics. The diet should be less stimulating and less rich, and fruits and farinaceous substances should be substituted for fatty articles; meat should not be excluded altogether from the diet, but it should be partaken of in smaller quantities than in Europe. If too much meat is taken in the tropics the liver and kidneys are apt to suffer. Soups and iced drinks in excess are also liable to lead to dyspepsia and not infrequently to dilatation of the stomach, a condition which may be suspected when there is nausea, dyspepsia, languor, palpitation, a yellowish conjunctiva and furred tongue.

The effect of over-indulgence in alcohol in the tropics is generally serious, ending in hepatitis and other disorders. Liver abscess, which is otherwise uncommon among natives, occurs among those who give way to drink. Among Europeans, neurasthenia, depression and incapacity for mental work are not an infrequent sequel to the consumption of an amount of alcohol which would be without any injurious result in a temperate climate. It is safest for the new arrival to abstain from alcohol and especially so if engaged in work that exposes him much to the sun. If alcohol is taken it should only be in the evening at dinner.

Sleep and Rest.—A sufficiency of sleep is essential to health in e tropics. Hot and sultry nights are prone to disturb sleep, e tendency to which is aggravated by irregular habits and hours going to bed. Lateness of hours should be avoided and an our's rest during the hottest part of the tropical day should be ken if possible.

In connection with bathing there are two axioms. The first is hat the water shall be free of infective organisms and secondly hat it shall be tepid or warm. In countries where ankylostoma nd bilharzia exist bathing in water taken from pools may be ttended with risk. Water for bathing, especially when travelling, hould be boiled and cooled. This precaution removes any risk of infection while at the same time it provides a tepid or warm bath which is generally more refreshing and safer than one which is cold. It is seldom that a cold bath agrees with those who have spent some time in the tropics; on the contrary, it often causes a chill and feeling of malaise.

Housing.—Good housing mitigates to a large extent the discomfort of climate; a house that is well-built with high rooms, a good roof, and a verandah of from 12 to 15 feet, on at least that aspect most exposed to the sun, is cool and comfortable. Few conditions connected with climate are more trying and more detrimental to the nervous system than having to live in a badly constructed house not properly protected against the heat and insufficiently ventilated. Houses should not be painted white, but green, dark yellow, or rown or dark red; they should have damp-proof courses in their alls and be provided with good surface drains and paving around em in order to keep them dry.

PROTECTION FROM INSECT-BORNE DISEASES.

iseases Disseminated by Insects. — Some of the most ortant diseases of the tropics are insect borne and require ial methods for their prevention differing from those adopted inst infectious diseases generally of a bacterial nature.

he main attack is on the insect carrier and its breeding-places, eral sanitary measures playing only a secondary part except en concerned in the abolition of breeding-places. Mosquitone diseases are by far the most common, the geographical disution of the mosquito being wider than that of the other insect riers of disease. Malaria is spread by different varieties of phelines infected with the malarial parasite. The most import of these malarial carrying anophelines are: *Anopheles culipennis, Myzomia listoni, Myzomia calicifacies, Myzomia* *funesta, Myzorhynchus paludis, Myzorhynchus sinensis, Nyssorhynchus lutzi* and *Pyretophorus costalis.* Other anophelines are being added to the list with the progress of investigation into the subject.

Yellow fever is carried by infected *Stegomyia calopus*, dengue by *Culex fatigans*, and filariasis by *Culex fatigans* and some of the anophelines.

Of the diseases disseminated by biting flies and other insects, the principal are trypanosomiasis by the tsetze fly (*Glossina palpalis*); simple continued fever by a sand fly (*Phlebotomu papatasii*); kala-azar by a bug (*Cimex rotundatus*); African tick fever by a tick (*Ornithodorus moubata*); and the bubonic form of plague not infrequently by the rat flea (*Xenopsylla cheopsis*).

Non-biting flies, owing to their scavenging habits, may becom soiled with infective material and occasionally spread cholera typhoid fever and dysentery. Outbreaks of typhoid fever and cholera have been directly traced to flies which have first of all fed on the bowel discharges exposed in a latrine and then proceeded to the kitchen and contaminated the food and milk. The bacillus of cholera has under these circumstances been recovered from the milk in which the soiled flies were found.

Malaria.—In a malarious country it is important for the European to reside at least a quarter of a mile from the native town. By so doing the chances of being bitten by infected mosquitoes are greatly lessened. A house close to native dwellings is always malarious because a certain percentage of the native children have the malarial parasite in their blood, and mosquitoes biting them become infective. The children are reservoirs which permit of a continual supply of infected mosquitoes in the neighbourhood. In an infected locality the more mosquitoes there are the more malaria there is, and hence, during the beginning and drying up of the rains there is a great increase in prevalence.

A mosquito net for the bed is an absolute essential in a locality with malaria or other mosquito-borne disease. Its mesh should be as fine as 20 strands to the inch. The curtains require to be let down and well fixed by being tucked under the mattress before sundown. It is not a safe arrangement for them to hang down and touch the floor, for mosquitoes that may have hidden under the bed will later have free access to the sleeper, while a slight wind catching the curtain may raise it sufficiently from the floor to destroy its protective properties. The most comfortable protection is that of a small mosquito house in which there is room not only for the bed but for a chair and table. It has also the advantage of avoiding any risk during sleep of an arm or leg coming in contact with the mosquito curtain and being bitten by a mosquito from the outside.

In a very malarious country such as West Africa, 5 gr. of quinine should be taken daily as a prophylactic. It can be taken at breakfast or at dinner, according to the preferences of the individual. With some quinine disagrees at night, causing sleeplessness. For these the morning dose is indicated. It is best to take it at meal times, for then it is less likely to be forgotten. The bi-hydrochloride is more suitable than the bi-sulphate. For less malarious countries, quinine at the malarial season is sufficient and should be particularly observed when camping out. Screening the verandahs, doors and windows of the house is now often carried out, though prejudices still exist against it. Objections are sometimes made to living in "meat safes," as screened houses are contemptuously called, but those who have dwelt in them usually find them so comfortable and free not only from mosquitoes, but also from the many flying insects which become at certain times of the year such a nuisance that they fully appreciate their worth.

In addition to these precautions every effort should be made to exterminate the mosquito and destroy its breeding-places in and around the premises. No European should omit to make a weekly inspection of his bungalow, compound and premises to ascertain that they are kept clean by the servants, that there are no empty sardine boxes, meat tins, jam pots, broken bottles or any other article lying about, which after a shower of rain could retain the smallest quantity of water and thus become breeding-places for mosquitoes. The inspection should include water tanks, saucers of flower pots, barrels, receptacles of every kind, out-offices and servants' quarters. It is essential to see that pools and puddles are brushed out dry, depressions and excavations filled up, everything containing water emptied and the water in the tanks which has to be stored should, besides being screened against the entrance of mosquitoes, have a small quantity of kerosene oil poured into it in order to destroy any larvæ contained in it.

Personal efforts to keep the house and premises free of mosquitoes may be largely neutralised by the carelessness of a neighbour who does not believe in the mosquito as a carrier of disease. It is accordingly the duty of the municipality or government in a malarious locality not only to attend to the scavenging and draining of the place in order to reduce malaria, but also to ascertain by regular and systematic inspection that each householder keeps his premises clean and free from larvæ and that the water tanks are properly screened. Following the example set by the regulations enforced in the Panama Canal Zone, many health authorities make it a punishable offence, for mosquito larvæ to be found on the premises of a dwelling-house.

Yellow Fever.—Where no *Stegomyia calopus* exist there will be no yellow fever, and it is on this basis that all administrative action has to be founded. If there are stegomyia they must be got rid of.

In yellow fever the important points which influence preventive measures are, that the period of incubation in man is from three to five days and that man only remains infective for three days; that the period of development in the mosquito is twelve days, and that the infected mosquito can transmit the infection to a succeeding generation of mosquitoes, each of which does not, however, become infective until fourteen days after its development into an imagine. Persons exposed to infection may be released on the sixth day if they remain healthy, but a locality which is infected requires eighteen days' freedom from the disease before it can be declared healthy.

A patient suffering from yellow fever must be isolated in mosquito-screened room or hospital, and those who have lived in the same house and the adjoining houses should be segregated and kept under observation for six or seven days in screened buildings. The wire mesh must be at least twenty strands to the square inch. The infected house and neighbouring houses should be fumigated with sulphurous acid, 4 lbs. of sulphur should be burnt for every 1,000 cubic feet of the room. At the same time destruction of larvæ is carried out on the same lines as in the campaign against malarial larvæ. Draining, filling up of pools, scavenging and removal of tins, bottles and refuse of all kinds, and the use of petroleum and other larvicides in water, have to be vigorously carried out on a systematic and regular plan. Besides these efficient screening of the water tanks and constant inspection, that the various measures have been taken and are being maintained are required.

The *Stegomyia calopus* is a domestic mosquito breeding specially in clean water in the water tanks, barrels and smallest receptacles of the house and premises. It is quiescent during the earlier part of the day, but bites during the rest of the day and night.

The general measures adopted for the abolition of the breeding places of anophelines and stegomyia practically resolve themselves into the destruction of all mosquitoes in the locality. By these measures the spread of dengue and filariasis is also checked.

Sleeping Sickness.—The risk of being bitten by the *Glossina palpalis* in fly areas may be considerably lessened by wearing suitable clothing, by having the European houses well removed from native dwellings and away from the river or lake, and by having the bush cleared for at least 200 yards from the premises. The house should also be screened with mosquito wire-netting.

All persons with enlarged glands should be carefully sorted out and the pulp of the affected gland and the blood of each examined microscopically for trypanosomes. When trypanosomes are found, the sick person should be temporarily isolated in a screened building and later removed, if possible, to a locality free of the *Glossina palpalis*. At the same time atoxyl should be regularly administered.

Insecticides.—Protection against bugs must be sought by cleanliness, by the soaking of the parts of a wooden or iron bedstead in carbolic acid, and by the washing of the joints with acetic acid. The room should be fumigated with sulphur or hydrocyanic acid generated from potassium cyanide. The latter method, however, is one which requires a trained man for its application, otherwise it is dangerous. When travelling a supply of Keating's powder is useful.

It is desirable that where these insect-borne diseases prevail a system of notification should be introduced so that measures to prevent their spread can be taken at once, also that the children should be taught at school, and the adults by lectures, the measures to be taken and the reasons for them.

PRECAUTIONS AGAINST INSANITARY CONDITIONS.

Excretal Diseases and their Dissemination.—Separation of the European quarter from that of the native renders much more easy the possibility of living under sanitary conditions; while it lessens the chances of dissemination of infective disease by mosquitoes and biting flies.

Typhoid fever and dysentery are diseases to which Europeans are peculiarly liable in the tropics; they are the result of insanitary conditions, and they are caused by eating or drinking something which has become contaminated with infected sewage. It is the same with cholera. They are essentially excretal diseases, and are, except the protozoal dysenteries, bacterial in their nature.

Human carriers, sick or healthy, and soiled clothing, are the agents by which the infective micro-organisms are transported distances or may be from one town or village to another, but the vehicle by which the infection gains an entrance into the system owes its contamination to some insanitary condition which has polluted directly the water, milk or food, or hands of the individual attacked. It has already been stated that flies contaminated with excretal matter from exposed latrines may carry the infection of these diseases to food and drink. But the most frequent source is the water of wells, ponds and tanks to which sewage has gained access or in which soiled linen has been washed.

Guinea worm, or dracontiasis, is another disease caused by drinking water contaminated with the embryos of *Filaria medinensis*, which are discharged from the wound of a patient suffering from the disease when bathing. The larvæ infect cyclops in the waters and gain an entrance into man when infected cyclops are swallowed.

Water and Milk should be Boiled.—With few exceptions, it is unsafe to drink water in the tropics without it being first filtered and then boiled. It is absolutely necessary to boil milk before drinking it, for it is a regular practice to adulterate the milk with water, which is always taken from the most convenient source irrespective of its purity and as often as not from a dirty pond, well or stream. The utensils, also, for holding the milk, are not infrequently kept in the sleeping room of the milk vendor. In order to secure good milk it is a custom in some places for the cow to be brought to the door and milked on the premises, the milk being received into utensils supplied by the purchaser, but unless the latter watches the procedure and has previously superintended the washing of the utensils it is unsafe to drink the milk unless it is previously boiled. Goat's milk should always be boiled before use, for the *Micrococcus melitensis* of Bruce has a wider distribution in the tropics than was known when the name of Malta fever was given to the disease caused by this micro-organism; in fact, the only article of food that can be taken raw in the tropics is good fruit grown off the ground. The water should be cooked, *i.e.*, boiled, the milk should be cooked, and salads, if eaten at all, should be thoroughly soaked and washed in water that has been boiled.

Improperly washed salads may retain the ova of *ankylostoma*, *tænia*, *triocephalus*, *Ascaris lumbricoides* and *oxyuris*, which in the manuring of the ground and watering the plants with liquid sewage may readily get attached to the raw vegetables.

Other Precautions.—Inoculation with anti-typhoid vaccine before proceeding to the tropics is a very useful precaution. It is in the first year of residence that the greatest danger of being attacked with typhoid fever lies, because it is then that the new-comer is less familiar with the customs and habits of the people around him, and from want of care or of knowledge runs risks which are later avoided.

It is also safer during an epidemic of cholera to be inoculated with anti-cholera vaccine. The prophylactic gives a high degree of immunity which continues at least through one cholera season.

Suitable, well-kept fly and mosquito-protected latrines, daily collection and safe disposal of the sewage and thoroughly protected wells or tanks, are essential for the prevention of the diseases mentioned. Scrupulous cleanliness of person as well as cleanliness in the preparation of food are also necessary. The kitchen should be inspected daily in order that it may be kept clean and all garbage removed and properly disposed of so as not to attract flies.

Particular care should be taken to inspect the fish and meat and other articles of food bought by the servant each morning immediately on arrival at the house and before they are taken into the kitchen. The slightest suspicion of decomposition or taint should be sufficient for rejection. Dysenteric diarrhœa, colitis and ptomaine poisoning are frequently caused by the eating of unsound meat or fish, and in some instances the results are fatal. Similar forms of illness have been caused by tinned meat, the tins of which have not been air-tight. Special care as to the soundness of food has to be taken in the tropics, where decomposition sets in more rapidly than in temperate climates and where tinned foods are often the only available supply. Most of these poisonings are due to infective organisms and their toxins, and the symptoms produced may vary according to the infecting bacillus and the amount of toxin ingested. Of the bacilli a large number conform to the Gaertner's group, some of which form spores, while others are non-sporing. The former resist exposure for a short time to a high temperature. All tins that bulge should be rejected, for it is a sign that the air has not been expelled or rendered sterile and that decomposition has taken place with the evolution of gas.

Beef should also be carefully examined for cysts or bladder-worms. These are the *Cysticerci bovis* which, when swallowed, infect man with the *Tænia saginata*. Pork is not or should not be eaten in the tropics owing to the scavenging habits of the pig, and accordingly there is not any special risk of the *Cysticerci cellulosæ* of that animal being swallowed and the individual becoming infected with the *Tænia solium*.

W. J. SIMPSON.

TROPICAL FEVERS.

BLACKWATER FEVER.

In the tropics, generally speaking, prophylactic meas diminish the amount of malaria cause a diminution in th of blackwater fever. Quinine in some cases certainly blackwater fever in a person infected with malaria, bot tropics and in England, many months after leaving a where the disease is endemic.

Irregular use of quinine seems to be most likely to caus accident. As a rule, blackwater fever occurs in people quinine only when they think they are out of sort feverish, and a moderate dose, such as 10 gr., may be quite to precipitate an attack. In other cases, where 5 gr. regularly, a sudden increase to 10 gr. may be followed water. A change from the system of 5 gr. a day to 10 a week, or even the change from intramuscular injections t by the mouth has been known to be followed by a sharp a

Some people have laid stress on the preparation of qui undoubtedly, in the majority of cases, the sulphate or b have been used, but these are the commonest prepar quinine in general use. Quinine hydrochloride is commonest preparation in use, and each year, as the use of best preparation of quinine, becomes more common, the n cases of blackwater fever attributed to it increases. I quinine takers the smallest number of cases occurs in per take daily prophylactic doses of 5 gr., and it is very rare persons to get blackwater fever, unless they increase the

Persons who have been in a country where malaria a water fever is endemic should continue the regular use o on the voyage home and for three months afterwards. I of these doses, and as a result of over-exposure or excess cise, food or alcohol, fever should develop, the patient sho bed at once and not increase the dose of quinine, but gradually the frequency with which it is taken. If taki doses daily, he might take 5 gr. twice a day for one day, th the next, and if the fever is not yielding, the same do four hours.

With the onset of blackwater fever, quinine should be discontinued. The corpuscles containing the parasites are destroyed early, and most of the parasites, sometimes all, perish.

The disease is an acute hæmolysis and we have no drugs that check this process. The treatment is essentially symptomatic. The great dangers are: (1) Suppression of urine due to blocking of the renal tubules by deposits of the hæmoglobinuric urine; (2) profundity of anæmia; (3) hyperpyrexia. The first is the most important cause of death, and as the blockage of the tubules commences from the onset of the hæmoglobinuria, the earlier treatment is commenced the less probability of extensive blocking.

The treatment essentially is to supply the blood so freely with fluid that the kidneys are constantly flushed. If the case is seen at or near the onset, the patient should take water or milk and soda freely. The supply of fluid must not be less than 10 oz. per hour; but as there is a tendency to vomiting, this must be given in a wineglassful at a time, or less, if there is any vomiting. This treatment if commenced early is, as a rule, successful, and vomiting does not occur.

It is less successful later and if vomiting has set in, probably renal in origin, rectal injections of normal or hypertonic saline (8 oz., or more if it can be retained) every hour will give a sufficient amount of fluid to keep the remaining tubules patent. If these enemata are not retained, subcutaneous injections of normal saline will be necessary.

In one way or other sufficient fluid must be given to cause an excretion at twice the normal rate, say 4 oz. per hour. If suppression sets in, fluid should still be freely supplied, but the case is, as a rule, hopeless.

Operative measures have been undertaken in these cases, and as the block occurs usually in the renal pyramids, incisions in the kidney have been made and a certain amount of urine has been passed under these circumstances through the wound, but no recoveries have taken place.

The second grave danger is from the extreme anæmia, and when it is remembered that in a severe attack lasting three days the red corpuscles may be reduced to little more than 1,000,000 per cubic millimètre, this danger will be appreciated.

We have no means of checking the blood destruction. What can be done is to treat the case as one of severe hæmorrhage. Absolute rest, the end of the bed raised, legs and feet in cotton-wool and bandaged to keep the blood in the upper part of the body, will usually give time for the rapid reformation of blood that takes place in the majority of instances. After the urine has cleared, aperients may be given if required, but not before.

In many cases the temperature begins to rise again a few days after the urine has cleared. This rise of temperature may be serious and hyperpyrexia occasionally occurs. As a rule, this temperature indicates the necessity for the use of saline aperients. In some cases it is malaria, as can be shown by examination of the blood. In these cases it requires cautious treatment with quinine, so as to run no risk of a relapse. Quinine should then be given in ½-gr. doses three times a day, gradually increased till the fever yields, and then continued in not more than a 5-gr. daily dose for three months. The patient must be warned that with any recurrence of fever (malarial) he must go to bed and not increase the quinine till he has been in bed twenty-four hours; then 4 gr. every six hours may be taken.

The general principle of this treatment is followed by most experienced observers. Some, however, will not allow fluids to be taken by the mouth for fear of causing vomiting, and rely either on rectal injections or on large hypodermic injections or on both. There is some divergence of opinion as to the use of purgatives. Many approve of an initial purgative in order to aid in the expulsion of any toxin, and perhaps if there has been constipation an initial enema is justified.

Drug treatments have advocates. The most popular is the use of Sternberg's mixture for yellow fever introduced by Hearsay: Hydrarg, Perchloridi, gr. $\frac{1}{60}$ Sodii Bicarbonatis, gr. 5; Aquam, ad ℥ij [U.S.P. Hydrarg, Chlor. Corrosiv., gr. $\frac{1}{60}$; Sodii Bicarbonatis, gr. 5; Aquam, ad ℥ij] every one, two or four hours. It appears to check vomiting and very good results have been recorded by Hearsay. McDowell advocated boracic acid solution in frequent doses. O'Sullivan Beare recommends a decoction of cassia beareana (1 drachm) well diluted with water, to be taken every two hours. The late Sir David Palmer Ross used drop doses of carbolic acid, well diluted, every hour.

In all these treatments a considerable additional amount of water is taken.

Stimulating diuretics, such as turpentine, have been strongly advocated by Cross and others. Quinine in large and frequent doses is not much used now, but in spite of attacks being in some people induced by it, recoveries have taken place in cases treated by 60 gr. or more per diem.

Use of Morphia.—In cases of vomiting hypodermic injections of morphia (¼ gr.) will often give relief. In the restlessness of the anæmia in the early stages of convalescence doses of $\frac{1}{12}$ gr. are decidedly beneficial.

Stimulants.—Alcoholic stimulants are necessary in the majority of cases after the first two days. They should be given well diluted and in small quantities at a time and, if possible, iced. Iced champagne and soda water in equal proportions is the most effective.

Local Applications.—Sinapisms or even blistering fluid to the epigastrium, or better to the neck, along the course of the pneumogastric nerve, will sometimes relieve the vomiting and even the hiccough which so often sets in in the worst cases. There is no objection to hot fomentations in the lumbar region or over the liver if the pain in these regions should be persistent. The objection to purgatives and also to sudorifics during an attack is that all the water possible is required to keep the kidneys flushed. If suppression is established life may be a little prolonged by their use. In cases of malaria following blackwater fever some authorities prefer the hydrobromide of quinine to the hydrochloride or sulphates.

Convalescence, as a rule, is rapid. There is no object in giving iron at first, as considerable amounts are stored up in the liver and elsewhere whilst the hæmolysis is taking place.

If the patients cease to improve after three or four weeks, iron and arsenic may be advantageous and possibly are best given as intramuscular injections.

Intercurrent diseases such as pneumonia are not uncommon during convalescence.

However complete and rapid recovery may be the patient should be warned not to return to a country where blackwater fever is endemic, and it is better not to go to any markedly malarial country, as he has proved himself to be a susceptible subject.

C. W. DANIELS.

DENGUE FEVER.

There is no specific treatment known and the treatment to be adopted is essentially symptomatic. The diet should be a liquid one, the bowels kept freely open with mercurials and salines and the fever reduced by warm sponging or hot packing.

In cases where the pain is severe hypodermics of morphia up to ¼ gr. may be required. Ordinarily small doses of Dover's powder are sufficient. Aspirin and phenacetin are extensively used by some authorities.

The actual mortality from the disease is practically *nil*, but convalescence is often prolonged and there may be for months recurrent pains in various joints and considerable debility.

Tonics, nutritious diet and, above all, a change to a cooler and more bracing climate, are advocated in such cases.

C. W. DANIELS.

JAPANESE RIVER FEVER.

This is a much more serious disease and the mortality in the aged is considerable. There is no specific treatment known. Quinine is usually given in considerable doses, but does not have any definite effect on the fever.

C. W. DANIELS.

KALA-AZAR.

The treatment of this disease is unsatisfactory. Symptomatic treatment, good nursing and sanitary conditions and change to a temperate climate prolong life. Specific treatment is in its infancy, but recoveries bave taken place under the prolonged administration of atoxyl and soamin, though failures occur and the good results are not seen till the drugs have been administered for a prolonged period. Considering the more powerful effects of antimony on other flagellates, it is possible that better and more uniform results may be obtained by the use of this drug, especially if given either as tartar emetic (1 to 2 gr. in 4 oz. of normal saline solution), or as finely-divided metallic antimony (½ to 1½ gr.) by intravenous injection. Antimony injected subcutaneously in man produces sloughing in so many cases that this method cannot be employed. By the mouth only small doses are tolerated, and though larger doses can be given per rectum, it is doubtful if much is absorbed, and the results in trypanosome infections are not equal to small doses (1 to 2 gr.) by intravenous injection. A combination of the intravenous and rectal injections will probably be the best method of testing this treatment.

As regards other drugs, quinine in large doses up to 60 gr. or more daily has failed. Methylene blue has also failed as well as arsenic in the maximum doses that can be tolerated by the mouth.

Specific treatments will probably ultimately be discovered, but t present are in the experimental stage.

As regards symptomatic treatment, abundant nourishing food an be taken. The tongue is clean and digestion in the earlier tages good.

Complications, such as hæmorrhage from the gums or elsewhere, an usually be treated by the milder local applications or by calcium hloride, but if untreated will subside spontaneously. Depressing ntipyretics must be avoided, as the fever is a long-continued one, nd quinine has no effect on the temperature. In the later stages, iarrhœa, often of a dysenteric character, sets in, and is best ontrolled by opium and astringents. Some authors, including ogers and Castellani, express a more favourable opinion of the alue of quinine than has been my experience. Rogers gives 0 to 90 gr. daily till the temperature falls and continues with 20-gr. doses. Castellani advocates large intramuscular injections combined with injections of quinine cacodylate or atoxyl.

C. W. DANIELS.

MALARIA.

Prophylaxis.—The radical method of prevention of malaria is the destruction of the anopheline mosquitoes which carry malaria from infected to susceptible persons. Failing this, the isolation of infected persons and their protection from the bites of such mosquitoes, combined with the protection of all susceptible persons from the bites of such mosquitoes by use of mosquito nets, of mosquito-proof rooms and of suitable clothing is effective.

Under present conditions none of these methods can be carried out completely, and therefore, as an auxiliary or even entirely, we have to rely on the prophylactic use of quinine.

The method which should be used in a badly malarial country, in addition to all or any of the above methods, is the regular and habitual use of quinine. Probably this acts by diminishing the susceptibility to infection, and not merely by destroying the parasites when introduced.

The prophylactic use of quinine is very general. Some use it only when going into or travelling through a malarial district or during a season when malaria is prevalent.

Medicinal Prophylaxis.—Many drugs have been and are still used for the prevention of malaria; opium, arsenic, and quinine are the only ones of importance. Opium was used extensively in the malarial fen districts, and is still used in many parts of India and elsewhere. In has no effect in causing the destruction of the parasites, but it is palliative and it does render the symptoms less marked, and in a moderate infection may reduce the symptoms to a minimum. It also diminishes the effect of chill. Arsenic, though little used for prevention, does diminish the anæmia. It also has no material effect on the parasites, which are still found in numbers. This applies not only to arsenic when given by the mouth, but also to the various arsenical compounds, cacodylates, soamin, etc.

As these drugs have no action, direct or indirect, on the parasites, they are of little value as compared with the drug which has so marked an effect, namely, quinine.

Use of Quinine.—Quinine is used for protection from infection in the treatment of all acute attacks and to prevent recurrence, and directly or indirectly to extirpate the infection. As quinine itself is insoluble, one of the salts is always used. Some of these are soluble in various degrees and others are insoluble.

Of the soluble salts, sulphates and bi-sulphates are the most commonly used, but hydrochloride and bi-hydrochloride are the best to use as they contain more quinine, they are more soluble, and the hydrochloric acid is less constipating than the sulphuric acid. The bi-hydrochloride is the most soluble of the quinine salts, and is, therefore, eminently suited for intramuscular injection. For ordinary use the cheaper and stronger hydrochloride is the best.

Prophylactic Use of Quinine.—The drug has to be taken for the whole period of possible infection, and in malarial countries this is necessary for a prolonged period. It must be remembered that it is not a harmless drug. The headache, buzzing in the ears, deafness and nausea are not of much importance, and moderate doses soon cease to cause these effects. Insomnia, atonic dyspepsia and nervous irritability are not uncommon results of the prolonged use of quinine. These disadvantages are much less than would result from unchecked malarial attacks, but no person who has any idiosyncracy as regards quinine should live in a malarial country.

As tested on a large scale in West Africa, the most successful results in the prevention of malaria are those which follow the daily administration of 5 gr. of quinine hydrochloride. This dose, in most cases, will produce no bad results. It is not, perhaps, quite enough, as infection and even attacks of fever do occur in persons taking this dose regularly. Few people can take larger doses regularly without bad results. In some cases the failures of this method are due to the use of sugar-coated tabloids, which are often passed through the intestines unchanged. Even uncoated tabloids may be passed in a similar manner in persons suffering from dyspepsia. Whenever the tongue is dirty the tabloids should be dissolved in water, and it is better always to take the quinine in solution.

Of the other plans adopted, probably the best is to take 10 gr. twice a week. As the excretion of quinine is slow and continues for four days or more, in this way there is always quinine in solution in the blood.

Koch advocated 10 or 15-gr. doses on two consecutive days on the 10th, 11th, 20th, 21st, and the last and last but one days of each month. This line of treatment was rather based on the recurrences of the febrile attacks, which are rarely less than nine days apart, and is acting on the supposition that infection has occurred and that you are anticipating the next febrile paroxysm.

TREATMENT OF AN ATTACK.

Complete rest in bed, a light diet, and attention to the actio of the bowels are essential, both during the actual paroxysm an in the intervals. In many cases the actual fever diminishes o even disappears in a person kept warm and at rest without drug or with much smaller doses than in a person who neglects thes precautions, and is up and about whenever he is not actuall disabled.

In the benign fevers, where the stages are marked, hot-wate bottles and warm blankets are comforting during the rigor, bu the patient must not be allowed to throw off the covering when th hot stage sets in. Hot drinks, such as weak China tea, expedit to some extent the sweating stage, and when this is over the patie should be sponged and supplied with warmed dry clothing.

If there is vomiting hot applications or sinapisms to t epigastrium give relief.

Pains in the head, back and limbs, are common, and aspirin phenacetin (5-gr. to 10-gr. doses) give relief, but should be used wi great caution; indeed, the use of them is only permissible in mi cases. They should not be given merely to reduce the temperatu The real treatment consists in the **administration of quinine**; a the doses of this drug used, the method and the time of its admin tration, are all dependent on the character of the fever, its severi and the presence or absence of complications. In the *benign feve* tertian and quartan, whether simple or double (quotidian), admin tration of quinine in solution by the mouth will usually suffi In these fevers the parasites sporulate all about the same time, a the young parasites before they enter the red corpuscles are mu more vulnerable than afterwards. Quinine in smaller doses is m effective when given shortly before the sporulation of the parasit This precedes the rigor by an hour or two, and consequently t best effects of small doses of quinine are obtained if they are giv three or four hours before the rigor is expected. The parasi which have entered red corpuscles will usually go through th full development and consequently the next rigor will occur, will not be so severe. Quite small doses (1 or 2 gr.) given shor before the expected rigors, are frequently effective, but larger do up to 10 gr. are more certain in their effects, and are theref better to use.

Though less scientific, the common practice of disregarding t stage of the parasite and giving 5 gr. every four or six hours widely adopted and has the advantage that the patient has r specially the symptoms of cinchonism at the time when he is made miserable by the febrile paroxysm.

With some cases of *malignant fevers*, the periodicity is almost as well marked as in the benign fevers, but in most it is not so, and sporulation occurs over a longer period or even continuously, some parasites sporing at one time and others at various intervals. In these cases it is of little use attempting to anticipate the time when the largest number of parasites will sporulate, and quinine must be given continuously. The doses need not be large in a person in bed, even small doses such as those contained in Easton's syrup will suffice to control the fever sometimes, and in more cases, doses of 1, 2 or 3 gr. of quinine hydrochloride every six hours will be sufficient. For an ordinarily severe attack doses of 5 gr. every four hours given by the mouth in solution are ample, but in cases of greater severity and when dangerous symptoms supervene, much larger (poisonous doses) are absolutely necessary, as unless quick action is obtained the patient may die. So far I have advocated treatment of the attacks by giving quinine in solution by the mouth. There are special advantages in other methods in some cases. When there is much vomiting, chronic or acute dyspepsia, quinine by the mouth should be avoided.

Intramuscular injections have many advocates. The salt to be used should be the bi-hydrochloride, as it is the most soluble. A daily injection of 9 gr. is ample in the majority of cases, and in rather more severe cases two injections or more may be given in the day. The quinine injected into the substance of a large muscle, such as the gluteus maximus, is probably precipitated and gradually absorbed, so that quinine in a more constant amount is present in the blood than by any other method of administration. The rate of absorption naturally varies and cases are not uncommon in which this method is not effective, though when replaced by quinine by the mouth it is so. This failure may occur in benign tertian and quartan as well as in some cases of malignant tertian. As there is uncertainty as to the rate of absorption the writer prefers not to rely on this method of administration in the most severe, the cerebral, cases of malaria, as death may occur in persons who have been treated for twenty-four hours or more by repeated intramuscular injections of quinine.

Certain precautions are necessary in the treatment by intramuscular injections. The quinine solution must be boiled before use and also the needle and syringe. The skin must be sterilised as for an operation. Failure in these respects has in several instances resulted in tetanus, and in many others in abscess formation. The injection must be into the substance of the muscle and not into the cellular tissue or merely subcutaneously. The injection must not be made into a part, such as the forearm, where the muscles are small, as in some instances the quinine escapes into the cellular tissue and may cause loss of function of a nerve, so that paralysis of a persistent nature ensues. This has happened several times after supposed intramuscular injection in the forearm. Ultimate recovery of the function of the nerve, usually the median, is the rule.

Intravenous injection is resorted to in some desperate cases by others; it is rarely necessary and not always successful even in patients who live for six hours or so after the injection. In the opinion of the writer, in the worst cases of malaria, intramuscular and intravenous injections, though usually successful, fail sufficiently frequently to be unreliable.

Rectal Administration.—Quinine is absorbed rapidly when given per rectum. It can also be given frequently so that the supply in the blood is constantly maintained at a high level. Small doses usually fail; large doses are required, as in these cases time does not permit of any experiments.

In the worst cases 20 gr. should be given by rectum and 10 gr. at the end of half an hour and for each hour after till the urgent symptoms disappear, then quinine can be given by intramuscular injection, by the mouth, or in less frequent doses, by the rectum.

In the very fatal malarial convulsions of children up to six or eight years of age the same plan of treatment is eminently successful; the doses required are large, much larger than would be given according to the ordinary proportional tables. In a child one year old the first injection should be 5 gr., and these doses should be continued till the convulsions cease. In a rectal injection to a child of this age, the buttocks must be compressed by hand in order to retain the enema. Any of the soluble preparations of quinine may be used, but the hydrochloride dissolved in a normal saline solution and given warm and high up is most likely to be retained. Some authorities prefer a thin mucilage as the medium in which the salt is dissolved or suspended. Under this line of treatment death will either occur within four to six hours of the commencement of the treatment or the patient will recover.

As aids in children hot baths should be given and in adults hot packing. Death usually occurs from cardiac failure, and in both adults and children alcoholic stimulants must be given freely. These act both as cardiac stimulants and as vasomotor ilators, so enabling the cerebral "block" to be more readily vercome.

The actual mortality in cases treated in this energetic manner is very small, and excluding patients practically moribund when first seen and dying in a few hours, may be said to be *nil*. The symptoms of cinchonism are very marked; deafness may persist for some weeks, and cases are on record of quinine amblyopia.

For persons who cannot take quinine there are no alternative drugs of equal value. In many such cases one of the insoluble forms of quinine or intramuscular injection may be tolerated. Methylene blue in pills or cachets (1 to 3 gr.) three times a day or more frequently has a similar but less reliable effect than quinine.

AFTER-TREATMENT.

Even when patients are treated with large doses of quinine relapses are the rule when quinine is discontinued, both in cases of malignant and benign malaria. These relapses usually occur two weeks or more after the last administration of the drug. In exceptional cases, after treatment with large doses of quinine, there is no return of malaria. A more or less prolonged course of quinine, in the opinion of the writer, is advisable in all cases. In the majority of the malignant malarial infections, a three months' course of quinine hydrochloride in 5-gr. doses daily is sufficient; in benign tertian and quartan a longer period may be required.

Even whilst these doses are being taken relapses may occur, and if they do, before any increase in the quinine is made, the patient must go to bed and the relapse is then to be treated as a first attack. The special risk of blackwater fever caused by increasing the doses of quinine suddenly in persons who have been in a country where that disease is endemic must always be borne in mind.

Differences of opinion as to the treatment of malaria are mainly as to the preparation of quinine used, the method of administration, and the dosage and the time at which it should be given. Any method is successful in a large proportion of cases and all kinds of doses; in the opinion of the writer, where so many successes occur, the disadvantages and rare failures are the only means of discrimination.

Many authors of great experience prefer intramuscular administration even in the most severe cases, and in most instances undoubtedly the results are rapid and excellent. Failures do occur; in an ordinary attack this only means delay; in a pernicious attack delay means death. Some combine the rectal administrations and intramuscular injections.

Warburg's tincture in doses of 1 to 4 drachms at one time enjoyed a great reputation. Most authorities now consider it only of value for the amount of quinine it contains. Some, however, as Leask of Singapore, think highly of it and claim recoveries when intramuscular injections and other methods of administration of quinine have failed.

C. W. DANIELS.

MALTA FEVER.

As the virus of this disease is contained in the milk of infected goats, and goat's milk, either alone or mixed with cow's milk, is the common method by which it is conveyed, fresh milk should not be used in any infected place. Boiling the milk does not appear to be quite reliable as a preventative, probably because it is not always carefully done.

There is no specific treatment. Vaccines have not been successful. The most dangerous complication is hyperpyrexia, which is fortunately rare, and must be treated by sponging or bathing.

As the disease runs a prolonged course, no lowering treatment is advisable, and antipyretics, such as phenacetin and salicylates, should not be used continuously.

During the febrile attacks warm or tepid sponging gives some relief and will lower the temperature and make the patient more comfortable. Quinine has no beneficial effect. When the pain is severe morphia may be necessary, but the dose should be small and repeated as rarely as possible. The headache may be relieved by bromides, but their use should be restricted as much as possible. The painful and swollen joints should be carefully bandaged in cotton-wool, and in some cases hot fomentations, strapping, and Scott's dressing give relief.

Where possible, local applications are preferable to general analgesics.

Some disturbance of the alimentary functions is the rule, but fluid and slop diet is required only when the temperature is high. During the periods when it is low good and abundant food can be taken, and the patient may be allowed to sit up, or if sufficiently protected from chills, to leave his bed. Constipation is common, and is best relieved by saline aperients. Diarrhœa occurs, astringents and dieting should be tried before having resort to opium preparations. A single dose of castor oil and tincture of opium (15 min.) [U.S.P. 10 min.] at the commencement of an attack of this diarrhœa may be permitted, as it sometimes puts a stop to it.

Careful nursing is required, and as the sweating is profuse, in addition to sponging, frequent changes into dry warm clothing must be made.

The protracted course of the disease, many months, is serious because of the debility induced and the consequent liability to intercurrent diseases. When there are no complications recovery will take place provided that the symptoms are treated as they arise and that the patient's strength is supported.

Stimulants may be required at any stage, but should not be give as a routine early in the attacks.

Convalescence is slow and is often aided by a change of climate.

C. W. DANIELS.

PHLEBOTOMUS FEVER ("SAND FLY" FEVER).

THIS fever is of so short a duration that little or no active trea ment beyond low diet and moderate purging is required. N specific treatment is known. It is possibly the same as the "thre day fever" described by Rogers.

C. W. DANIELS.

PLAGUE.

BEFORE discussing some of the more important of the special methods for the treatment of plague by means of antiseptic drugs, serum-therapy and organo-therapy, none of which can claim much success, it may be well to emphasise certain points in reference to the general management of the disease.

GENERAL MANAGEMENT OF A CASE OF PLAGUE.

Initial Precautions.—Pneumonic cases, fortunately few in most epidemics, are virulently infectious through the emanations from the lungs, and should be dealt with in hospitals, where due precautions against spread of the disease can be adequately provided; but bubonic and septicæmic cases may be safely treated in the wards of ordinary hospitals, or in their own homes, provided measures against rats and their fleas are taken. The Second Indian Plague Commission (1905–1907) proved conclusively that the rat-flea is the principal, and probably the only, transmitter of plague, other than the pneumonic form. Immediately on the publication of its report, the outlying special hospitals in Hong Kong, for instance, were abandoned to other uses, and all plague cases are now treated in the general hospitals or in cottage hospitals scattered throughout the city, so placed as to obviate the necessity for conveyance of the sick to any great distance. Previous experience in that Colony had already shown that the members of the staff of a plague hospital run practically no personal risks.

If a case is to be treated at home, rats should be hunted out, and disinfection with special reference to destruction of fleas must be done, not after recovery, but as soon as the diagnosis is declared. Combined methods should be employed for the extermination of rats:—traps should be set with varying baits, changed every night or two; poisoning is best done by a paste containing 2·5 per cent. phosphorus, or by barium carbonate in dough (1 in 4), or spread on fish or moist toast; bird-lime, spread on boards and baited like the traps, is very effective; and Danysz's virus, which kills the rat by inducing a specific septicæmia, if it is available, should also be used, spread on bread and exposed near the rat-holes.

Clothing, bedding and the like may be disinfected by steam; but it is to be noted that the ordinary gaseous and chemical disinfectants for infected rooms are useless against fleas. These insects may, however, be readily destroyed by the application to bedsteads, walls, floors, etc., of an emulsion of kerosine oil described by Captain W. Glen Liston, I.M.S.,[1] and made as follows: 3 parts of Sunlight soap are dissolved by boiling in 15 parts of water; hot kerosine oil is slowly added to this soap solution, up to 100 parts, and the whole is very thoroughly mixed. It is probably better, reserving this emulsion for prophylactic purposes, to disinfect in the presence of plague with a combined pulicide and germicide, and this is provided in a mixture of equal parts of petrol and cyllin, diluted with water for use. In a dilution of 1 part of the mixture to 200 parts of water this has been proved, experimentally and practically, efficient and reliable for the destruction of both fleas and plague bacilli.

Contacts.—Contacts (*i.e.*, persons who may presumably have been exposed to the bite of fleas in the circumstances where infection of the patient occurred) should be inoculated with Haffkine's prophylactic, which not only protects the healthy for a period of several months, but aborts the incubating disease. This is a broth culture of the plague bacillus, killed by heat, and containing the dead bodies of the bacilli and the products of their growth with a minute quantity of carbolic acid added as a preservative. The prophylactic is standardised, and the dose, varying according to strength from 2 to 5 cubic centimètres, is marked on the bottles. Inoculation is made by means of an anti-toxin syringe, with rigid asepsis, usually in the left upper arm. The results of the inoculation vary. Many persons are only slightly indisposed, and able to go about work as usual, while others are considerably out of sorts for a day or two. The site of inoculation is generally swollen and painful, and the axillary glands enlarged and tender. The temperature rises to 101° or 102° F., and in some cases may run as high as 104° or 105° F., with accompanying headache, nausea, malaise and general discomfort; but even in such cases the unpleasant symptoms pass away within two or three days.

Other prophylactics have been prepared by Lustig and Galleotti, Terni and Bandi, Strong and Kolle, and Klein; but Haffkine's fluid has maintained its reputation as the safest and most satisfactory preparation.

Disinfection during the Illness.—As to arrangements for general disinfection during the illness, it will probably be a sufficient guide to practitioners having to deal with plague for the first time if it is stated that they should be approximately the same as for typhoid fever. It is abundantly proved that the rat, which is the principal source of danger to human beings, is rarely infected through the alimentary canal; but it certainly may be so infected, and since the fæces, urine, sputum, etc., of a plague patient frequently contain plague bacilli, adequate means for their disinfection should be taken before they are put into the drains. Carbolic acid (1 in 20), cyllin (1 in 200 in an alkaline solution), corrosive sublimate (1 in 500 in an acid solution) are the most commonly used disinfectants for this purpose.

Nursing.—Careful nursing of a case of plague is of the first importance. On account of the marked tendency to heart failure in this disease the recumbent position is essential so long as acute symptoms last, and in delirious patients, who are often wildly resistive, has to be maintained by mechanical means, shackles having sometimes to be used for several days. The patient's mouth should be cleansed systematically with a solution or the glycerine of boric acid, and his body sponged daily with a dilute antiseptic, such as cyllin in tepid water. Retention of urine is frequent, and close attention to the state of the bladder is necessary. Doors and windows should stand open day and night, and bedclothes should be of the lightest description. Nurses should be warned of the possibility of infection through skin wounds, and even the slightest abrasion of the hands should be carefully closed with collodion. All unnecessary visitors should be excluded.

Food.—Food should be of a bland character, liquid, and given in small quantity frequently. During the acute stage milk is most satisfactory, given in 3- or 4-oz. two-hourly feeds. It may be supplemented by soups, egg-flip, etc., and a certain variety may be attained by use of the various meat preparations, *e.g.*, Brand's essences of chicken and beef, bovril, Valentine's meat-juice, lemco, oxo, etc. After acute symptoms subside the diet may be rapidly improved. Cold water should be freely at disposal between the feeds, and should be frequently forced on acutely ill or delirious patients.

Stimulants.—The use of cardiac stimulants should be a routine practice in all cases of plague from the very first. Great prostration occurs as a rule within a few hours from the commencement of the illness, and in the earliest stages the debilitated heart needs support. There is great variety in the drugs that may be used, and considerable difference of opinion as to the value of, or necessity for, the use of alcohol. My own practice has been to give, in an ordinary moderate case, brandy (4 oz.), spread over the twenty-four hours in ½-oz. doses, with a mixture containing tinct. digitalis ♏5 and liq. strychninæ ♏5 [U.S.P. strychnin. hydrochlor., gr. $\frac{1}{22}$]

every six hours. In more severe cases strychnine was given hypodermically four-hourly; and other stimulants were called into requisition as circumstances required, *e.g.*, strychnine and strophanthus together hypodermically, caffeine, ammonia, ether, etc. Choksy, of Bombay, speaks favourably of suprarenal gland, which he used in the form of Oppenheimer's renoglandin, as a remedy for the arrest of heart failure in plague.[2]

Symptomatic Treatment.—The further treatment of plague is purely symptomatic; attempts to find a specific remedy, to be discussed later, have been made, and some success has been claimed, but a plague specific is still in the future. If there is constipation at the beginning of the illness, a purge of calomel (4 gr.), followed by a saline, is useful; later, it is better not to give any strong purgative, but to open the bowels by means of enemata. Diarrhœa occasionally occurs, when the discharges are found to be loaded with plague bacilli; and intestinal antiseptics are called for, with increased solicitude for the maintenance of the general strength, meat preparations being meanwhile discontinued, and milk diluted with lime-water or peptonised; while in severe cases opiates may be required.

For the reduction of high temperature in plague the depressant antipyretics, such as antipyrine and phenacetin, should never be employed. Ice-cold applications should be used; and a most satisfactory method is to cover the body with towels wrung out of iced water, and rapidly changed as may be found necessary to keep them cold until the required fall of temperature has been secured.

It is well to discontinue the cold applications when the temperature taken in the rectum comes down to 102° F., as the downward tendency may continue after their removal, and the risks of collapse must in this, as in every other detail of the treatment of plague, be kept in view continuously. Having stopped at 102° F., however, a careful watch should be maintained, and cold re-applied immediately on the curve of temperature turning up again, say at 103° or 103·5° F., without waiting for a further threatening of hyperpyrexia. Cold packing as usually applied or cold sponging may be done; but the method described is simple, easily applied and exceedingly efficient.

Cold cloths are also of use locally for headache or the control of delirium. Headache may yield to caffeine citrate (2 to 5 gr.). For delirium and insomnia resort has often to be made to hypnotics; and probably the most generally useful is morphia ($\frac{1}{4}$ to $\frac{1}{2}$ gr.) or hyoscine ($\frac{1}{100}$ gr., given hypodermically), alone or with such drugs as choral and bromide of potassium, trional, etc., by the mouth. Calcium chloride or adrenalin may be used to control hæmorrhage.

Pneumonic Plague.—No special treatment for the pneumonic form of the disease is indicated, other than the general measures already described; but on account of its intense infectivity rigid isolation is necessary, and nurses should be specially warned as to careful personal prophylaxis.

The Bubo.—The treatment of the plague bubo has been the subject of much discussion, but the consensus of opinion is against excision of it. To excise the bubo has seemed to me the removal of a probable barrier to the rapid absorption of the plague bacilli, while meantime doing an injury through shock or the use of an anæsthetic to a patient whose vitality is already at a minimum. Moreover, a large proportion of the buboes of patients who recover resolve without suppuration, and it is not possible to say beforehand what will be the termination of any particular bubo. My treatment has been entirely conservative: green extract of belladonna, with glycerine in equal proportions, being applied freely on lint in the early stage; warm poultices when suppuration is seen to be inevitable; and simple incision and scraping with a blunt spoon being done when that process is well established; the resulting wound being treated on ordinary surgical principles. The application of ice-bags to the early bubo relieves pain and tenderness, and these may be used in addition to the belladonna. Injections into the bubo of carbolic acid, iodine, creolin, corrosive sublimate and other antiseptics have been advocated, but no substantial benefit seems to have resulted from any of them.

The Point of Inoculation.—The point of inoculation should always be looked for, and, if discovered, it should be attacked vigorously. Unfortunately it is rarely to be found. In experimental plague, while the point of inoculation is marked by œdema in ordinary laboratory animals, there is usually no apparent lesion in monkeys; and this accords with what occurs in human plague. But occasionally there may be seen on a limb, below the bubo, a papule with an inflamed base and a clear vesicle at the top, the contents of the vesicle swarming with plague bacilli in almost pure culture. The interpretation seems to be that the advance of the bacilli has for some reason been arrested, and that the bacilli are proliferating locally, pouring chiefly their toxins only into the circulation. In any case, destruction of the papule is usually followed by abortion of the illness and a rapid recovery. The contents of the vesicle should be received on a swab moistened with strong carbolic lotion; the papule should then be transfixed and a deep crucial incision made; and finally the tissues should be deeply cauterised with pure carbolic acid, applied by means of a piece of pointed wood, and then a simple dressing put on.

Ulcer and Carbuncles.—The indolent ulcers that sometimes result from the buboes and the gangrenous skin areas, so-called carbuncles, occasionally met with, are only manifestations of the general depression, and their treatment is on general principles.

Convalescence.—Convalescence is frequently slow, and the profound enfeeblement frequently resulting from the illness, with the mental and other sequelæ that sometimes occur, have to be dealt with by nutritious feeding, tonics, change of air, etc., as the individual cases demand.

SPECIFIC METHODS FOR THE TREATMENT OF PLAGUE.

It remains to discuss a number of efforts made to find a specific remedy for plague, in the directions of antiseptic drugs, serum-therapy and organo-therapy.

Antiseptic Drugs.—Attempts have been made to introduce carbolic acid into the tissues in sufficient quantity to delay the proliferation of the plague bacillus and allow the natural reaction against the organism time to assert itself. As phenol, even in the minute doses usually administered, is rapidly absorbed from the stomach, and for a considerable time can be found in the blood unchanged, there seemed ground for the hope that a sufficient concentration might be obtained for the purpose in view.

In 1901 I used this drug in doses of 80 gr. a day in a series of 204 cases, but, while the Hong Kong Plague Hospital mortality in that year was 76·5 per cent., slightly less than the average, I did not think it had been much affected by the treatment. In 1902 I used serum treatment, with negative results to which I shall presently refer in detail; but in 1903 I returned to my experiments with carbolic acid. I determined to push the remedy to the utmost, and, while watching carefully against appearances of poisoning, to give the drug in large doses so long as plague bacilli could be detected in the blood or serum from the bubo. I accordingly gave 144 gr. of carbolic acid daily, divided into two-hourly doses of 12 gr. each, administered in a mixture as follows:—acid. carbolic. pur., gr. 12; syr. aurant., ʒj; aq. chloroform., ad ℥j. [U.S.P. phenol. gr. 12; syr. aurantii, ʒj; aq. chloroformi, ℥ss; aquam, ad ℥j.] Sig. 1 oz. to be given two-hourly, and to be diluted with water before use.

Carbolic acid, thus administered, was taken in large amount by some of the patients ere the prescribed condition was satisfied. To ne patient, for instance, a severe septic case, non-bubonic, in which iolent delirium required the use of shackles for nearly a week lmost continuously day and night, over 2,500 gr. of pure carbolic cid were given before the blood was free from plague bacilli, when n excellent recovery was made. Carboluria, which is probably due ore to impurities in the acid than to the drug itself, rarely ccurred in course of this series of experiments; where it did occur, he omission of one or two doses was usually sufficient to clear he urine and allow resumption of the remedy. In certain cases yspeptic symptoms occurred, but in these greater dilution of the ixture with water was sufficient to overcome this obstacle to its onsumption. The drug was thus employed over a series of 143 ases, and the mortality was only 36·4 per cent. Unfortunately, in he earlier part of the epidemic I had been testing the curative value f the antiseptic oil of cinnamon, which proved useless, and the esults with carbolic acid were obtained in the later part of the pidemic, when there is a greater natural tendency to recovery, he disease being invariably more virulent early in the epidemic, o for this circumstance due allowance had to be made.

Further experience in Hong Kong has confirmed my belief that arbolic acid, while in no sense a specific remedy, is of undoubted alue in the treatment of plague, when given in such doses as to llow its sufficient concentration in the blood to exert an inhibitory nfluence on the proliferation of the plague bacillus. This remedy as curiously impressed itself on the Chinese imagination in Hong ong; and many thousands of bottles of it are annually distributed n plague-stricken parts of the mainland by wealthy Chinese esidents of the Colony as a matter of charity, accompanied by areful instructions for its use, compiled by one of my former hinese assistants, and actually embodying the routine treatment of he disease in the Hong Kong Hospitals. Most favourable reports of the esults attained are given, which, however, it is impossible to verify.

Other observers in India, etc., have reported less favourably on carbolic acid; and trials made with formic aldehyde, injected intravenously, cyllin, injected intravenously, oil of cinnamon by mouth, etc., have proved these of no greater value.

Serum-therapy.—The position as regards the serum treatment of plague is pretty much that described in reference to carbolic acid and other antiseptics. Most unequal results have been obtained by different observers, among different races and in different epidemics. In comparing reports of results by all the methods of treatment, it is important to note that European races show a much larger proportion of recoveries, irrespective of treatment.

In 1902 I treated in Hong Kong a series of ninety-four cases with a serum supplied in monthly instalments by Calmette from the Pasteur Institute in Paris, using the method of administration and the quantity recommended by him. The average initial dose was 40 cubic centimètres intravenously and 20 cubic centimètres subcutaneously on admission, and then 20 cubic centimètres subcutaneously on each subsequent day while fever lasted. The hospital mortality was 85 per cent., higher than in any previous year, and I concluded that the serum was of no value, though deterioration through lapse of time and through exposure to hot temperatures during transit from Paris probably contributed to this result. Serum treatment has been used in Hong Kong repeatedly in the years that have followed, but with no better results.

On the other hand, in Oporto 140 cases were treated, with a mortality of only 14·78 per cent.; and in Brisbane fifty-six persons were treated, with a mortality of 44·6 per cent.; thirty-nine, with a mortality of 17·2 per cent.; and sixty-five, with a mortality of 13·8 per cent. The European nationality is to be borne in mind in reference to these.

N. H. Choksy,[3] whose opportunities for the observation of the treatment of plague in the Maratha Plague Hospital at Bombay are unrivalled, has recently reported on the subject.[4] He tested the value of the Yersin-Roux serum supplied by the Pasteur Institute of Paris. He rejected cases already septicæmic and unlikely to benefit by any treatment, as also convalescent and semi-convalescent cases, and patients who had passed the fifth day of the illness. Observation was thus limited to cases of acute illness within the first five days from the onset, and alternate cases were treated with serum, while the others were observed as controls. Results were as follows: 200 control cases—mortality 74 per cent.; 200 cases treated with serum—mortality 63·5 per cent.; difference in favour of serum treatment, 10·5 per cent. Of 468 cases treated with serum in private practice, and in which there was a greater preponderance of cases treated on the first or second day of the illness, with better social circumstances, the mortality was only 32·9 per cent. Other serums were tested, *e.g.*, Lustig's, Terni's, Cruz's, Kitasato's, etc., but results were less favourable.

A detailed account of experiments on Plague Serum-therapy is given by Professor W. J. Simpson in his "Treatise on Plague" (Cambridge University Press).

Indian experience generally seems to indicate that case-mortality is but little affected by the use of any serum yet prepared. But the course of the illness is favourably affected, especially if serum is used on the first day of the disease. There is a reduction of temperature, a lower rate of pulse and respiration, less delirium and restlessness, more tendency to resolution of the bubo, less general discomfort, and a more rapid convalescence.

Intravenous injection is probably most efficacious, with at the same time subcutaneous injection into the lymphatic area, draining towards the bubo; and instead of the doses at first recommended, 200 to 300 cubic centimètres should be given.

Organo-therapy.—Another method for the treatment of plague, the use of adrenalin chloride, is described by E. N. Thornton as a result of experience in South Africa.[5] This drug was advocated as a special remedy in the "Calcutta Practitioner" in 1904 by Rai Bahadur Kailaschandra Bose, and we have already referred to Choksy's use of renoglandin as a measure for the arrest of heart failure in plague, but the suggestion from South Africa is claimed as independent.

Thornton was led to the use of this powerful cardiac stimulant and constrictor of the peripheral blood vessels by a consideration of the extreme congestion of all the internal organs so typical of plague, and in particular by the marked degeneration that occurs in the supra-renal glands, loss of whose function, he surmised, might account for some at least of the phenomena of this disease.

He used Parke, Davis & Co's 1 in 1,000 solution of adrenalin chloride in doses of ♏30, together with tinct. strophanth., ♏10, [U.S.P. ♏3.] by mouth four-hourly for the first three days, and then thrice daily during a further period of fourteen days. Later experience led him to give the drug at first subcutaneously or intravenously, and in part into the neighbourhood of the bubo, and afterwards to keep up its action by oral administration. The mixture of adrenalin and strophanthus does not keep, and must be freshly prepared.

The mortality among fifty cases thus treated was 26 per cent.; while in 936 cases in which adrenalin had not been used the mortality was 37·4 per cent. The blood pressure was raised, the heart stimulated, collapse averted, and less extravasation occurred around the bubo; but there was no effect on the delirium or the insomnia. There is thus an apparent advantage; but the number of cases is insufficient to justify more than an opinion that the remedy is worthy of more extended trials.

J. C. THOMSON.

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UNDEFINED TROPICAL FEVERS.

Imperfectly differentiated fevers of the tropics are yearly diminishing in number, as the causes of one after the other are being discovered.

They may be divided into two groups: (1) Those in which the fever is of short duration; and (2) chronic febrile conditions which may be remittent, undulatory or intermittent in type. Of the first group, from which phlebotomus fever has been recently separated, the causation is so far unknown, though probably in some instances temporary digestive disturbances or slight sunstroke may be responsible. The danger to life in this class is slight and treatment is entirely symptomatic. To this group belong the seven days' fever of Rogers, possibly the same as Crombie's simple continued fever, and a three days' fever described by McGarrison, which may be the phlebotomus fever.

A serious disease, the rare hyperpyrexial fever described by Thompstone and Bennett in West Africa, is a fatal disease in some cases and in others recovery takes place in about a month. The nature of the disease is unknown. It does not yield to quinine. Cool bathing, sponging and packing are of value.

The second group is of more importance and the diagnosis is difficult. Till a few years ago, in this group would have been included kala-azar, some cases of amœbiasis, some of schistosomiasis, ankylostomiasis, etc.

The essential point before commencing treatment is the exclusion of these diseases and also of chronic malaria, of syphilis, Malta fever, ulcerative endocarditis, chronic septicæmia, paratyphoid, and above all of tuberculosis. The exclusion of these diseases is often difficult, and so many of the chronic undifferentiated fevers terminate in definite tuberculosis, that a large proportion of them are probably tuberculous in origin. In some cases the diagnosis is only arrived at by the effect of treatment.

In many cases it is advisable for a short course of treatment to be undertaken with full doses of the drugs which are known to have specific actions. The order the drugs should be tried in must be decided in each instance by the probabilities.

(1) Potassium iodide and mercury.

(2) Quinine, intramuscularly and by the mouth.

(3) Ipecacuanha in full doses. A course beginning with 30 gr. and 5 gr. less each day till the dose is reduced to 5 gr. per diem is as good a method as any.

(4) Soamin or atoxyl in 2-gr. doses, given as intramuscular injections daily or every other day for one or two weeks.

In all cases the patient must be kept warm in bed, the diet should be light and the bowels freely opened.

It is assumed that all the ordinary methods of diagnosis, including blood examination for parasites, serum reactions and puncture of liver and other organs, have been made and negative results obtained.

In the greater proportion of the cases, if each of these lines of treatment are used in turn for ten days, the fever and other symptoms will subside. It does not necessarily follow that the fever is the one for which such a treatment is supposed to be specific, but the presumption is in favour of it.

In case the undifferentiated fever yields to none of these remedies, treatment must necessarily be symptomatic, but it must be remembered that though the course of these fevers of unknown origin is a chronic one, recovery is probable, provided the patient's strength is maintained. As liberal a dietary as the patient can digest is an important part of the treatment; but in considering the diet, special care has to be taken to exclude aberrant forms of typhoid and paratyphoid fever and intestinal tuberculosis. Bacterial examination of the urine must be made as some of these continued fevers are due to coli infection.

In summing up the consideration of the principles of treatment, the most important point is only to group fevers as undifferentiated or unclassified, after an exhaustive exclusion of all the known causes of pyrexia.

C. W. DANIELS.

YELLOW FEVER.

Prophylaxis.—Prevention is comparatively simple, as the breeding places of the mosquito which carries the disease, *Stegomyia calopus vel fasciata,* are near the houses inhabited by the adults. Strict isolation of all cases inside a mosquito net both day and night is essential, as the young mosquito will feed in the day-time. After the first four days of the disease this isolation may to some extent be relaxed. All mosquitoes in an infected room should be destroyed by fumigation. Non-infected persons must be carefully protected by clothing and the use of nets at night in the neighbourhood of an infected house. Protection before dusk is not essential, as the older mosquitoes of this species, those that have fed at least once, rarely bite in the day-time.

The **treatment of an attack** is symptomatic. There is no specific treatment known. At one time a favourite treatment (Blair) was a large dose of calomel and quinine, 20 to 22 gr. of each. Palmer Ross used drop doses of carbolic acid. The modern treatment is to give a small dose, up to 5 gr., of calomel, at the commencement of the attack, followed by repeated doses of Epsom salts (℥j.) till there is free purgation, and to continue with doses of alkaline carbonates at frequent intervals. Many prefer Sternberg's mixture: Sodii bicarb., ʒij; Hydrarg. Perchlor., gr. $\frac{1}{3}$; Aquam, ad ℥ix. An ounce or an ounce and a half every hour.

It is of considerable importance, in view of the tendency to vomit and the gastric congestion, that all articles of food and drink, including medicine, should be well iced. Vomiting may to some extent be relieved by hot applications sinapisms or blisters to the epigastrium, but hypodermic injections of morphia up to $\frac{1}{4}$ gr. may be required.

Headache, which so often is distressing, may be relieved by hot packing or cold applications to the head and hot to the feet. No bright light should be allowed and the room must not only be darkened but as quiet as possible. The synthetic antipyretics, such as phenacetin, antipyrine, etc., should not be given, as they all have some depressant cardiac action. Hæmostatics, such as turpentine, calcium chloride and adrenalin, are used when there is "black vomit" or when hæmorrhages from the various mucous orifices occur.

Suppression of the urine is the great danger; in this disease it is due to a toxic nephritis. Hot fomentations to the loins and a free supply of water are of value; enemata of normal saline solution (8 to 10 oz.) should be given every few hours as soon as the urine begins to be secreted slowly or the albumin to increase rapidly. Great gentleness must be exercised in giving these enemata, as hæmorrhages readily take place from the rectum in this disease. Carroll advises the injection of urea hypodermically to stimulate the renal action. Cardiac failure, warning of which is often given by a phenomenally slow pulse, is best treated by hypodermic injections of strychnine ($\frac{1}{60}$ gr.) and alcoholic stimulants.

There is no object in giving food whilst there is vomiting—at the most iced milk and soda water may be given. In severe cases rectal injections are impracticable, as bleeding occurs so readily from this mucous surface.

C. W. DANIELS.

GENERAL DISEASES.

BERI-BERI.

The causation of beri-beri is not certain, but appears to be dependent on some deficiency in cereal food, which in most cases is rice.

This deficiency is not readily made good except by the substitution of other cereals or by the use of rice less highly polished.

A liberal dietary in which barley, corn, or other cereals replace rice or the use of rice imperfectly polished or prepared in the Indian manner by boiling or steaming before drying and husking in the majority of instances will prevent the development of the disease.

An attack of beri-beri is essentially a rapidly developing multiple neuritis. The special danger is implication of the cardiac nerve supply and consequent heart block or heart failure. The œdema, the paralysis and wasting of the muscles, the effusion into serous cavities, are of comparatively slight importance.

The development of the neuritis is so rapid that death may occur in less than forty-eight hours in a person apparently previously in good health. In these fulminating cases nothing can be effective, though the treatment should be the same as for a severe attack.

In any case of beri-beri, the diet should be a liberal one but should not include rice or any bulky article of food. The change in the diet may result in a checking of the neuritis in its early stages. Bulky food has to be avoided, whether fluid or solid, because the nerve supply to the stomach is also disturbed, and distension readily occurs. The distended stomach pressing on the embarrassed heart is a frequent cause of cardiac failure. Fluids may be given freely, but only in small measured quantities, 2 to 4 oz. at a time. Food, which must be liberal in quality, should be given frequently, but restricted as regards quantity. Cardiac tonics, as a routine, are better avoided. Perfect rest in bed must be insisted on.

In the acute cardiac attacks inhalations of amyl nitrite and trinitrin must be given at once to maintain the vaso-dilatation. If the attack does not yield to the amyl nitrite, venesection must be at once performed. As the onset of these attacks is often sudden and without warning, the amyl nitrite capsules and instruments for venesection must be kept close to the patient, so that there is no delay. Oxygen inhalation is of some value, as an addition, in these attacks. Hypodermics of strychnine, $\frac{1}{60}$ gr. are of value after or during an attack. The danger of death from one of these cardiac attacks is greatest during the early stages of the disease, but continues, though to a diminishing extent, during convalescence. Practically all the danger to life of the disease is from cardiac failure.

There is usually some pericardial and pleural serous effusion, but rarely in sufficient quantity to require surgical treatment. During convalescence there is much wasting and loss of power of the muscles, and if care is not taken there may be contractions and flexions of the joints which may require surgical treatment. The commonest is for the ankles to be more or less permanently extended.

When acute symptoms have subsided, massage and passive movements may be practised with advantage, and, later, active movement should be encouraged. The condition of the heart must be carefully watched as there is even in advanced convalescence, some risk of cardiac failure.

Strychnine in small doses or drachm doses of Easton's syrup are of considerable value in the later stages of convalescence. Some authorities are in favour of using strychnine or digitalis as a outine in beri-beri, others, including Manson, restrict the total quantity of fluid taken during the œdematous stages. The use of adrenalin has been advocated on theoretical grounds. If there is extreme restlessness in the early stages, small doses, $\frac{1}{10}$ or $\frac{1}{12}$ gr., of morphia hypodermically are advantageous.

It is of great importance that any concomitant disease, such as malaria, should be actively treated, and for some reason quartan malaria especially is often a fatal complication. If the paralysis of the limbs is marked, care should be taken that the feet are kept flexed and the joints moved from time to time. Cradles should be used to prevent the pressure of clothing from keeping the feet extended. Splints may be required. Very rarely distortion is sufficient to require tenotomy or other surgical measures.

Convalescence as a rule is slow and weakness of extensors, especially those of the thighs and feet, persists for weeks and months, and is sometimes permanent.

Relapses are common in persons who are again exposed to the conditions under which they developed the disease. These relapses may be more severe than the original attack and are probably due to dietetic errors, such as too large a proportion of rice and that rice too highly polished. Less severe relapses occur as a result of exposure to wet and cold, of injury or operation, after childbirth and with the onset of intercurrent diseases such as malaria or dysentery. Care must therefore be taken long after an attack has apparently ceased to avoid such occurrences.

C. W. DANIELS.

EPIDEMIC DROPSY.

As the causation of the disease is unknown, no definite method of prophylaxis can be given. Probably some of the so-called epidemics are in reality beri-beri, or closely related to it, and in that case, dietetic deficiencies should be remedied.

As in this disease there is little or no cardiac paralysis, the prognosis is good. Rest in bed and symptomatic treatment is all that is required in the earlier stages. As anæmia and cardiac weakness are frequent, iron and digitalis or strychnine or strophanthus should be given as soon as the acute symptoms have subsided.

C. W. DANIELS.

TRYPANOSOMIASIS.

In this article, by Human Trypanosomiasis is taken to mean an infection due to *Trypanosoma gambiense.* Of the treatment of the human trypanosomiasis ("Schizotrypanosomiasis") of Brazil we at present know nothing.

Serum Therapy has at present no place in this disease; treatment must be by chemical substances.

General Principles of Chemiotherapy.—It should be the aim of the physician to destroy all the parasites, that is to say, to *sterilise the tissues* with the first dose or doses, and so to prevent a relapse. For this there are three reasons:

(1) The earlier in the course of the disease effective treatment is applied the better chance there is of cure; after each relapse the parasites become more difficult to kill. (2) After a few doses of trypanocidal drugs the tissues are apt to become hypersensitive, so that the remedy must be abandoned. It is obvious that if all the parasites are quickly killed the treatment need not be continued. (3) The trypanosomes may rapidly become resistant to the drug, so that doses which kill a normal strain are ineffective; moreover, resistance developed against any member of a class is exercised against other members also and finally against all trypanocides.

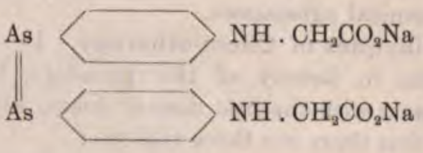
It is probable that the best chance of obtaining a permanent cure is to commence treatment at a moment when the parasites are numerous in the blood. The dissolution of a large number is believed to set free antibodies which kill those that may have escaped destruction.

Prompt sterilisation, the goal of the therapeutist, cannot however always be attained. In the case of some drugs the effective dose is so near to the dangerous or lethal dose that it cannot be employed with safety. Treatment must then be continuous or be renewed at intervals, or more than one trypanocide must be given.

This brings us to another important principle, that of *combined therapy.* The members of the different classes, or even of the same class, destroy the parasites in different ways, some, for instance, by attacking the protoplasm, others by reacting with the apparatus which subserves cell division, so that multiplication is impossible. If we employ two drugs instead of one, sterilisation is more easy to attain and the doses need not be so high as when either is employed singly. The value of combined therapy has been amply demonstrated by animal experiment.

There are three classes of drugs which are trypanocidal: basic triphenylmethane dyes; benzidine dyes; and arsenicals. The last class is by far the most important; besides organic and inorganic salts of arsenic it includes antimony.

Arsenophenylglycin.—Of the arsenicals the most effective appears to be arsenophenylglycin, discovered and tested by Ehrlich and his collaborators. It has the following formula:



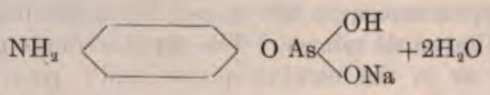
The arsenic is in trivalent form. Arsenophenylglycin has a great affinity for the trypanosome and, except after repeated doses, little for the tissues; consequently it is less poisonous than other allied substances, such as atoxyl. It is a yellow powder which is easily decomposed in the presence of air and then becomes very toxic; it is therefore sealed *in vacuo* in glass tubes. It is readily soluble in water. When it is required for use the tube is broken, the powder is dissolved in sterilised cold water to form a 10 per cent. solution (some recommend 5 per cent.) and, the skin and syringe having been carefully cleansed, the solution is injected into the muscles. The site of the injection does not matter. There is, as a rule, no irritant action, but it is well to rub the spot gently; pain, if it occurs, is transient. Von Raven has fixed the maximum dose, and that therefore which should always be employed, as 50 to 55 milligrammes per kilo body weight. This is to be divided and given half on one day and half on the next. Three grammes have been administered at once without any ill effect. The drug is injected in the morning; the patient is kept in bed and, if he has no symptoms of intolerance, the dose is repeated the following morning. If there is a marked rise of temperature, irregularity of heart, or twitching, the second dose should not be given, or should at least be postponed twenty-four hours; such symptoms however are rare. A scarlatiniform rash and transitory weakness of the lower extremities have been observed later.

Twelve hours after an injection of arsenophenylglycin the trypanosomes are found to have disappeared from the blood and glands, and in favourable cases they do not return. The blood should be systematically searched at intervals of a week or less and a careful cord kept of the temperature; a rise of temperature, especially if companied by headache, is suggestive of relapse. If there are no rther symptoms and no return of trypanosomes, the patient quires no further treatment. If a relapse occurs within six weeks, her drugs should be tried (*see* below); if the interval before lapse is eight weeks, two more doses may be given as above. It ust be remembered that the patient may be free from symptoms, id from trypanosomes as far as can be ascertained, for many onths and afterwards relapse. The trypanosomes may reappear the blood or in the cerebro-spinal fluid; recurrence in the ands is rare. If parasites cannot be found in the blood but the tient's state is not satisfactory, the cerebro-spinal fluid should examined.

It is essential that the above directions for the use of the drug be llowed; if an attempt is made to give smaller doses at more equent intervals or to prolong the course, alarming symptoms pear, such as colic, vomiting, œdema, bronchitis and jaundice. eath may occur from heart failure, or the acute symptoms may be llowed by weakness and emaciation progressing till death. Such ents are due to hypersensitiveness of the tissues, or to accumulan of the drug in the body, or to both these causes. After one or o doses they have never occurred.

There are certain *contra-indications* to the use of arsenoenylglycin or indeed of any organic arsenical. Thus, it should ascertained that the patient has no tendency to degenerative anges in the retina or optic nerve, and that his excretory organs d heart are sound. Enquiry should be made as to previous atment because, if arsenic in any form has been recently taken, e patient will be unduly susceptible. It is wise also to test his sceptibility by the use of the cutis and ophthalmic reaction. r the former a 2 to 3 per cent. solution may be used; for the ter an 8 per cent. solution instilled into the conjunctiva. If the action is positive, other treatment should be employed. Von ven, who has had more experience with this drug than any other server, does not advise its employment in advanced cases, ., where somnolence, fits, tremor, or mental symptoms are esent.

Other drugs of the arsenical class which have been found fective are the arsanilates, atoxyl and soamin (also described as yl-arsonates), and antimonial salts, such as tartar emetic. The sanilates are inferior to arsenophenylglycin in two respects: the senic is in pentavalent form and has to undergo reduction in the dy (Ehrlich), whereas arsenophenylglycin is already reduced; they are more poisonous to the tissues than arsenophenylglycin (there are many cases on record in which loss of vision has occurred after their use). On the other hand, they are better known and appear to be able to effect cures in suitable cases. **Atoxyl** or **soamin** (Burroughs, Wellcome & Co.) is the monosodium salt of para-amino-phenyl-arsenic acid or arsanilic acid. It has the following graphic formula:



The amount of water of crystallisation varies somewhat. It is a stable salt under ordinary conditions, but the solution in water undergoes changes if it is kept, or if it is heated for more than a few moments; it then becomes more toxic and is usually yellow. Yellow solutions should always be rejected. It has no action on trypanosomes *in vitro* and owes its efficacy in the living body to the fact that it undergoes some change in the tissues, believed to consist in the reduction of pentavalent to trivalent arsenic. Of the two preparations soamin is the cheaper and is perhaps less toxic.

There are several methods of giving the arsanilates. That which has found most favour is an injection under the skin or into the muscles of 0·6 gramme every tenth and eleventh day, but the advocates of this dosage agree that it is best to commence with one large dose, say 1 gramme. The solution is made in sterilised water just before use or it may be boiled for one minute in a test-tube; 20 per cent. is the strength usually employed. There is no agreement as to how long such a course should be continued, but if it is to last more than a month careful watch should be kept on the visual fields; for limitation of the fields is the first sign of affection of vision. This is an important point, because the process which produces impairment of vision at the periphery ends rapidly in complete optic atrophy. Peripheral neuritis also has occurred after a long course of atoxyl. It is probably wise to intermit the treatment after two or three months.

Some authorities, notably Sir Patrick Manson, believe in the prolonged and continuous administration of small doses of soamin or atoxyl. Manson believes that if the drug is persevered with the parasites ultimately disappear for good. He gives 1 to 4 grains by injection twice a week. In one case he gave 9; in another, where an apparent cure resulted, 2·3 grains was never exceeded. He has treated six Europeans on these lines and all but one, who died of pneumonia, were free from symptoms in June, 1910;

three have made an apparent recovery. Some, however, received other drugs as well. It is probable that the beneficial effect of small doses of atoxyl is due to an increase of the body resistance.

In a small proportion of cases atoxyl is ineffective from the first. Though large doses are given the trypanosomes do not disappear from the blood. In such a case, in the absence of arsenophenylglycin, an antimonial salt may be substituted. In other instances such symptoms as gastralgia and vomiting necessitate suspension of the remedy or reduction of the dose. A rise of temperature within a few hours of the injection is not abnormal; the cause is, in some instances, the dissolution of the parasites and the absorption of endotoxins.

Arsacetin, the acetyl derivative of arsanilic acid, seems to have few or no advantages over atoxyl and soamin.

Tartar Emetic (potassium antimonyl tartrate), owing to its irritant properties, must be introduced into the veins; 0·1 gramme is given in 1 per cent. solution; the dose may be repeated twice a week, or daily for seven to fourteen days. A medical man who attributes his recovery to one course of this drug had seventeen such injections. Care must be taken lest the solution leak into the tissues. Some advise that the drug be given in plenty of water by the mouth. Aniline antimonyl tartrate is used in the same way as the potassium salt.

Arsenious Acid.—Some of the Europeans first found to be infected were treated with Fowler's solution and have apparently recovered. This drug, however, in the highest doses tolerated is not strongly trypanocidal. It should be used in combination with more efficient remedies.

The basic trimethylmethane and the benzidine dyes have not hitherto proved of much value in the treatment of human trypanosomiasis; *tryparosan* (Ehrlich) seems to be one of the best; it is given by the mouth.

Combined Therapy.—*Soamin* and *perchloride of mercury* have given fair results, but it is uncertain whether these will be lasting. Solutions of 1 gramme of the former and 0·02 gramme of the mercurial are injected at the same time and with the same syringe. The soamin is repeated every fourteenth or fifteenth day, the perchloride every fourteenth (van Someren).

Soamin (or atoxyl) and *potassium* or *sodium antimonyl tartrate* form a combination which has been extolled by some; the arsenical salt is given once a week, the antimonial once or twice a week, or in series.

Trisulphide of arsenic (orpiment) and *soamin* or *atoxyl* have been used by many. A short course of the organic preparation is followed by a long course of the inorganic arsenical salt by the mouth. The doses of the latter may be gradually augmented till 1 gramme or more is given in the day. If it is badly borne, a little opium may be added. Inorganic arsenic has the advantage that to it trypanosomes do not become resistant. Other associations may be used; indeed in the present state of our knowledge most cases of human trypanosomiasis should be treated by a combination of drugs.

The progress of treatment may be tested by the examination of the patient's cerebro-spinal fluid obtained by lumbar puncture. This should be clear and microscopically almost free from lymphocytes. It should of course not contain trypanosomes. It is probable that all persons whose cerebro-spinal fluid has been so invaded are beyond the reach of our present drugs.

General Treatment.—Though much space is here devoted to chemical treatment it must not be supposed that the management of trypanosomiasis is summed up in drugs. Good constitutional treatment, except in recent infections in which the disinfectant acts quickly and promptly, is at least as important. The patient should not return to the tropics till there are grounds for believing that he has recovered and he should be spared any work that is not of a light and congenial character. Residence at a high altitude may be beneficial. He should live well in every sense of the expression. The value of careful constitutional treatment is shown by the fact that of the Europeans who were first found to be infected some five seem to have recovered and these had very little treatment by drugs.

A. G. BAGSHAWE.

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Vide Sleeping Sickness Bureau Bulletin, 1910, Nos. 20 and 23.

Summaries of these papers will be found in the Bulletins of the Sleeping Sickness Bureau.

ABDOMINAL DISEASES.

CHOLERA.

The treatment of cholera has passed through many phases in recent years, but after these are carefully analysed, the only conclusion possible is that there is no specific treatment for the disease. As good results as any are obtained by following up a purely symptomatic and expectant course. Koch's discovery of the specific germ in 1883 showed the true nature of the disease, and opened up a vast field of research for prophylactic studies.

PROPHYLACTIC MEASURES

for a disease due to an organism which is spread chiefly by contaminated water must necessarily be difficult in countries where Asiatics form the bulk of the inhabitants; but though this is so for general methods, much good can be done in the way of saving the white inhabitants by taking careful personal precautions.

General Prophylaxis.—This must aim at a pure water supply, an ideal condition easy enough to obtain in large cities that have proper water supplies, but much more difficult to obtain in the country, where the water may come from tanks, wells, polluted rivers, and other similar sources. In such places the collecting areas must be rigidly protected from natives as far as possible. This is by no means an easy matter when wells are used, because these are generally surface wells, and may quite easily be contaminated from a distance. Milk of itself is safe, but at once becomes dangerous if diluted with infective water; therefore the milk supply must be enquired into and placed above suspicion. Religious pilgrimages are a constant danger, as the members of such collections carry the disease about with them and scatter it broadcast throughout the country. It is difficult to see how such meetings could be put down, and it is equally difficult to apply ordinary methods of sanitation to the crowds of people such as are found in them.

Personal Prophylaxis.—This may be conveniently discussed under three main headings: (1) Anti-choleraic vaccination; (2) Personal hygiene; and (3) Treatment of diarrhœa and bowel troubles.

(1) *Anti-choleraic Vaccination.*—A considerable amount of evidence

has now been collected in favour of the use of Haffkine's system of vaccinating against cholera. The method consists of the injection of living and virulent cholera microbes under the skin. The germs do not give rise to an infection with cholera, but die, and in so doing give off substances which are protective against future attacks of the disease acquired in a natural manner. How long such an immunity lasts has not yet been accurately determined, but the period is probably a short one. Though the incidence of the disease is reduced, the case-mortality does not appear to vary. This indicates, according to Macleod, an anti-microbic rather than an anti-toxic action of the protecting substance.

The method of making the vaccine is roughly as follows: Agar tubes are inoculated with pure cultures of the cholera spirillum and are then incubated for from twenty-four to thirty-six hours at a temperature of 40° C. At the end of that time the slope of the agar should be covered with a uniform layer of growth. Sterilised water is then added—to roughly a third of the height of the agar—and the mixture shaken in order to wash the growth off and form an emulsion. Of this $\frac{1}{2}$ cubic centimètre (about 9 minims) forms the dose for an average adult. Only vaccines that come from a reputable laboratory should be used, and when cholera is rife all Europeans and as many natives as possible should be inoculated.

(2) *Personal Hygiene.*—It must always be remembered that the new-comer to a country is always very liable to contract the disease, therefore where possible such individuals should not be sent to districts where an epidemic is raging.

Various conditions are always quoted by writers on the subject as being liable to bring on an attack of cholera, and though manifestly those of themselves cannot do so, yet they might weaken the digestive apparatus and so render the bowel more open to the invasion of the specific cholera germs. Bodily fatigue, mental worry, eating unripe or raw fruits (melons and cucumbers), eating unwashed and uncooked vegetables, eating decomposing food, particularly fish and shell-fish, drinking milk that has been standing exposed, drinking dirty water, drinking too much alcohol, may be mentioned as examples of these conditions. To be on the safe side great care must be taken with all food and drink. Though contaminated water supplies are one of the main causes of the spread of cholera, it must never be forgotten that flies—just as in typhoid fever—may act as the disseminators of the germs, by carrying them on their feet from an infected stool to the milk-jug or any exposed solid food standing in the larder or house generally. All food, especially milk, must be thoroughly protected from such insects, while dishes and tables upon which food is to be eaten should always be kept scrupulously clean and protected from flies when not in use. No meals should be taken unless the viands have been cooked immediately before the time for eating them, and things left over should be disposed of to the servants, as far as possible, so as to prevent their use on subsequent days.

No water or milk is to be drunk that has not been boiled, and it is of equal importance that after sterilisation it should not be handled by dirty servants nor stored in dirty unsterilised containers. Filters, unless of modern manufacture, such as the Pasteur-Chamberland or Berkefeld, are to be condemned, and the same applies to domestic water coolers and ice chests unless attended to with scrupulous care. All drinking vessels, eating utensils, plates, cups, etc., are to be cleaned after use in boiling water only, and dried either by heating or with sterilised towels.

Failure to attend to such minor details often ends in disaster. Screening of windows to prevent the access of flies should be carried out wherever possible. If the whole house cannot be dealt with, rooms such as the kitchen and dining-room should be selected first. If flies could be rigidly excluded from houses there would be less cholera.

(3) *Treatment of Diarrhœa and Bowel Troubles.*—During times of epidemics the bowels must be attended to very carefully. Diarrhœa and other minor maladies of the stomach and intestines, which at first sight seem to be trivial, have an unfortunate tendency to develop into real attacks of cholera, and therefore should never be neglected. For this reason salines and purgatives should be avoided at such times. Any looseness of the bowels should at once be treated with astringents, and if the symptoms still prevail the patient should be put in bed, kept warm, and be fed with the greatest care. Drugs of use in checking preliminary diarrhœa are: Chlorodyne, chlorodyne and brandy, tincture of opium, catechu, kino, asafetida, black pepper and opium, lead and opium, chalk and opium, and combinations of these in different forms.

TREATMENT OF AN ATTACK OF CHOLERA.

This naturally divides itself into the treatment of the three stages of the disease: (1) The stage of invasion; (2) the stage of collapse; and (3) the stage of reaction.

(1) **The Stage of Invasion.**—Anti-toxic sera may be tried at this stage, the Japanese believing that they have obtained success by such a treatment. If a supply of such a serum is at hand it is only right to use it, as it is unlikely that it can cause any harm; but,

on the other hand, many believe that it will also do no good. The moment that cholera is suspected, the first thing to do is to place the patient in bed, and to prepare him as far as possible for the struggle he is about to undertake.

He should be kept in the horizontal position, and must pass his stools into a bed-pan suitably heated. The bed must be kept warm, the surface of the body kept dry by wiping with warm towels, and surface heat conserved by hot bottles.

Thirst may be best met by giving sips of iced water or aërated water. Large quantities of fluids are to be avoided owing to the danger of setting up vomiting, which tends very quickly to increase the exhaustion. In this stage of the disease food and medicines by the mouth are best withheld for the same reason, and the patient should be kept as quiet as possible. The blinds of the room should be drawn and the bed disturbed as little as possible. The patient should not lie under too many bedclothes, and the temperature of the room should be kept between 70° and 75° F. Macleod recommends for the treatment of the cramps, which may be agonising, moderate and intermittent chloroform inhalations, friction with anodyne liniments, or moderate counter-irritation with turpentine, mustard, or camphor liniment. Hypodermic injections of morphia have also been tried.

(2) **The Stage of Collapse.**—Failure of the pulse must be energetically met, as otherwise death will certainly take place. In the early stages Macleod advises mild stimulants, such as iced champagne and soda-water, weak brandy and water (iced), or ammonia or spirits of chloroform. Later, especially if the force and volume of the pulse still decrease, more active measures must be tried. Nitrite of amyl, nitro-glycerine and hypodermic injections of ether may be given, but at the same time preparations should be made for the injection of normal saline into the veins. This may be done in one of two ways: intermittently or continuously. For the first, 60 gr. of sodium chloride and 30 gr. of sodium carbonate are dissolved in 1 litre of distilled water, sterilised by boiling, and injected into a vein in the arm or into the subcutaneous tissues. Not more than 1 litre should enter in ten minutes but as many as three may sometimes be required to restore the pulse. For the second, a similar solution is used, the fluid being placed in a vessel 2½ feet above the patient's arm. From here it gravitates continuously and slowly into the vein, and is prolonged till all risk of collapse has disappeared.

According to Macleod, the proportion of recoveries has not been materially increased by the use of such injections; but still he them to be justifiable, as life is prolonged and in some s might therefore be saved.

he Stage of Reaction.—If any tendency towards suppres- urine should appear, hot poultices should be applied over s, or the kidney regions behind may be cupped, either by ; or dry methods. The catheter should be employed if n exists. For persisting diarrhœa Catani recommends large nt rectal injections (tannic acid and gum arabic, 20 grammes ; water, 1 litre). Such injections are to be made slowly blood heat. Astringents and antiseptics, such as salicylate uth, may also be tried by the mouth.

tment of the Discharges.—All cholera stools must be dis- and destroyed as soon as possible after being passed. linen and bed clothing must be suitably sterilised, and nts must be very careful in disinfecting their hands. Out- rines should be protected from flies by screening the build- d chemical disinfectants should also be used unsparingly.

alescence.—A very simple diet must be kept up for a rable time during convalescence. An injudicious return to ood may lead to serious results. The return to normal however, after the disease has disappeared is usually

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ACUTE DYSENTERY.

There is no doubt that much of the confusion that has arisen in the treatment of acute dysentery has been due to a deficient diagnosis of the particular variety of the disease. Dysentery is only a term including many different etiological factors, and each individual type must be accurately diagnosed before success in treatment can be hoped for. In this article it is proposed to deal with bacillary and amœbic dysentery only, other forms such as Bilharzial Dysentery, Malarial Dysentery and Kala-Azar Dysentery being dealt with under their respective headings.

BACILLARY DYSENTERY.

This is the form of dysentery met with in asylums, pilgrimages and amongst troops during campaigns. It is characterised by its epidemic tendencies, and this fact is sufficient to make one suspect its presence. Dysenteric bacilli of the Shiga, Flexner or Kruse type are demonstrable in the stools; but such a differentiation is beyond the ordinary individual, unless a laboratory is at hand where the necessary media for growing and separating these germs are kept. For general clinical purposes, if a case of acute dysentery occurs during an epidemic, if no amœbæ are demonstrable in the stool (an examination quite within the limits of the general practitioner), and if other causes such as malaria and helminths are also absent, then it may be called a bacterial case and treated as such. Experience has now shown conclusively that for this type of dysentery treatment by salines is the best, and these should therefore be given.

General Treatment.—The patient should be placed in bed, kept warm and be furnished with a bed-pan to pass his stools into. Diet is to be restricted to milk, weak beef-teas or weak broths. A milk diet is the best. If thirst is present, water may be given in small quantities. If abdominal pain is excessive, hot fomentations or turpentine stupes may be applied over the abdomen, and if the anus becomes irritable, which it is very likely to do owing to the constant purging, it should be washed after each motion with hot weak antiseptic lotion. Some of the stool should be kept in a stool-glass and inspected daily, especially after treatment has begun, as otherwise it is difficult to say what progress is taking place. The stools when passed should be carefully disinfected and then destroyed; flies

ust never, where possible, be allowed access to them, because they
ill carry the germs on their feet to milk or other food, and so con-
minate this and spread the disease. Very probably this is one of
e main causes of the spread of epidemics of bacillary dysentery in
ylums. In the case of soldiers actively engaged in war it may be
finitely said that it is the main cause. There does not appear to
any great tendency to relapse in this form of dysentery, and
er abscess does not follow it.

Medicinal Treatment.—The saline treatment consists of the
hibition of sulphates in 1-drachm doses every hour or so, until the
ute symptoms disappear and the stools become more or less
rmal again. The two salts that are most commonly used are
lium and magnesium sulphate. The former is preferable on
count of its less irritating qualities. There are many different
ys of giving these salts: for example, they may be dissolved in a
tle hot water (ʒj to a quarter of a tumbler of hot water) and then
unk, or they may be combined with other drugs in the form of
escriptions, so: Buchanan's mixture. ℞ Magnesii Sulphatis,
; Acidi Sulphurici Dil., ʒiij; Tinct. Zingiber., ʒiij; Aquam,
℥viij [U.S.P. ℞ Magnesii Sulphatis, ℥ij; Acidi Sulphurici
l., ʒiij; Tinct. Zingib., ʒjss; Aquam, ad ℥viij]. Sig.: One or
o teaspoonfuls to be taken every one or two hours until gentle
rgation appears. Continue less frequently for one or two days
er the blood and mucus have disappeared. Another prescription
as follows: ℞ Sodii Sulphatis, ʒj; Acid. Sulph. Aromat., ♏xv;
. Cinnamomi, ad ℥j [U.S.P. ℞ Sodii Sulphatis, ʒj; Acid.
lph. Aromat., ♏x; Aq. Cinnamomi, ad ℥j]. Sig.: ℥j every two
urs till relief is obtained. Or, ℞ Magnesii Sulphatis, ʒss or ʒj;
. Cinnamomi, ℥j. Sig.: 1 oz. every hour till free purgation
pears.

The proof that the salts are acting beneficially is furnished by
e lessening of pain and tenesmus, also by the disappearance
f mucus and blood from the stool, and by the appearance of copious,
oft, feculent motions. If the stools become watery the amount of
he salt must be reduced or stopped altogether. After the acute
ymptoms have disappeared, a further dose or two may be given for
few days, especially if any tendency to constipation appears.

Diet must be light and nutritious during convalescence, all alcohol
hould be stopped, and the patient should be warned about getting
hills.

Serum Treatment.—Anti-dysenteric sera may eventually prove
o be of value. It is essential, of course, that the serum used should
ave been prepared from the specific bacillus causing the attack in

the given individual (*e.g.*, from a Shiga strain, or from a Flexner strain, or from some of the many other different strains that have been isolated from such conditions).

Vaccine treatment might also be tried. The specific organism present in the stool would have to be isolated (this is no easy matter), and then a vaccine could be prepared in the ordinary manner.

AMŒBIC DYSENTERY.

The treatment I have found most efficacious in acute amœbic dysentery is the ipecacuanha one, as recommended by Sir Patrick Manson, and I shall therefore describe it first. By amœbic dysentery is meant cases of endemic dysentery in which amœbæ (*Entamœba Histolytica*) can be demonstrated in the fæces. There will also be countless organisms present, chiefly bacilli, but the presence of the amœbæ is to be taken as indicative that the case is one of amœbic and not of bacillary dysentery. This may not appear very scientific, but some such clinical classification is essential.

General Treatment.—The patient is to be confined to bed, put on a milk diet, kept warm, and is not to get up to pass his stools. The latter must be passed into a bed-pan. As a rule abdominal pains are not so excessive as to require fomentations; but if they are, hot fomentations or turpentine stupes may be employed.

Medicinal Treatment and Diet.—Before commencing the regular treatment a preliminary dose of castor oil and opium may be given, say the day before—on Monday, for example, if the ipecacuanha treatment is to begin on Tuesday. The effect of this on the patient and the character of the stool passed is be carefully noted. On the following day milk may be given in the morning and at mid-day, but nothing is to be given after that, so as to ensure that the patient's stomach is empty by the evening. At 8 p.m. 15 to 20 [U.S.P. 9 to 12] drops of tinctura opii are administered, in the hope of preventing the vomiting the ipecacuanha so often sets up, and then at 8.30 p.m., as the patient is coming under its influence, 30 gr. of powdered ipecacuanha are given either in pill form, bolus, or capsule. Some patients keep such a dose down without any trouble, but, on the other hand, many bring it up, so further precautions have to be taken. It is a good plan, for example, to place a mustard leaf or mustard poultice over the epigastrium at the same time as the opium is given (8 p.m.). In addition, after the ipecacuanha is given the patient must lie flat on his back without a pillow, and he is not to speak or move for two or three hours at least. If sickness appears he must try as far as possible to prevent ıself from vomiting, and the nurse should carefully swab out h cotton-wool any excess of saliva that may appear in the ıth. This latter precaution is very important. If vomiting urs it does not follow that all the ipecacuanha is brought up, refore the second dose should be given at its ordinary time, on second evening, and not before. On the morning of the second , or before that if nausea has disappeared, small quantities of ırishment (milk preferably) are indicated, and these may be eated at frequent intervals up to mid-day. At 8 p.m. a procedure ilar to that adopted on the first night is again carried out, the y exception being that the dose of the ipecacuanha is reduced by r. (*e.g.*, 25 instead of 30 gr.). The third night another reduction gr. brings the dose to 20 gr., and yet another on the fourth ht to 15 gr. The fifth night the tincture of opium should stopped, and only 10 gr. of ipecacuanha given, and then after t 5-gr. doses every evening may be continued as long as essary.

'he proof of the drug doing good is the disappearance of all blood mucus from the stool, copious soft, yellow motions appearing ead. This ipecacuanha diarrhœa, as it really is, is beneficial, is what we should aim at producing. After the drug is stopped, ften before that when the smaller doses such as 5 gr. are being en, the stool should become solid again, gradually recover its normal our, and show no signs of blood or mucus on the surface of the d fæces. Diet in the following stages is all-important, because of great tendency of this form of dysentery to relapse. After the ol has become solid, milk diet should be continued for a week, then ll goes well, a very slight increase to milk puddings may be tried, dually proceeding from this to a very light fish or white meat sine. Ordinary food should not be taken for at least three months, l all alcohol should be strictly prohibited during this period of time, even for longer. The liver should be carefully examined during l after the attack, so that in the event of an abscess appearing gical treatment may be requisitioned (*see* Liver Abscess, Vol. I.). ere is no doubt that many cases of amœbic dysentery treated such a manner get rapidly well, and if the patient is careful rwards he may never pass into the chronic stage.

)ther Treatments.—The Americans have not found ipecacuanha cessful in the treatment of cases of amœbic dysentery in the lippine Islands, and they recommend in its place the use of *ine enemata.* These should be used warm (at the temperature he body), the strength of the quinine varying from 1 in 1,000 in 1,500. Two or three litres may be introduced, the amount depending on the size of the colon, and the injection should be retained for fifteen minutes at least. The enemata should be frequently repeated, but if cinchonism appears, the number must be reduced, or the amount of the salt in each be appreciably diminished. If extreme irritability of the rectum is present, preliminary injections of morphia in hot water may be required. A long tube or colon pipe is necessary to give the enemata, and one has to beware of pushing this through the ulcerated gut. *Calomel,* for the treatment of acute dysentery, has also had its advocates. Some give it in 5-gr. doses every six or eight hours, or in fractional doses every hour. Bismuth and opium, bismuth alone, simaruba, cinnamon, monsonia ovata and pomegranate are the names of other drugs that have been tried. Most of these, however, are of greater value in the treatment of chronic dysentery.

Prophylaxis.—A pure water supply is the greatest safeguard against amœbic dysentery.

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CHRONIC DYSENTERY.

Chronic Dysentery is a term used for two different clinical conditions: (1) A sequela of an acute attack or of a series of acute attacks; and (2) a distinct disease in which there has not been any acute stage, but in which there has been prolonged irregularity of the action of the bowels with the occasional passage of mucus or of blood and mucus. In many of these cases there is alternately constipation and diarrhœa. There is no object in calling these cases "colitis"; the causal agent is often the same as in one or other form of acute dysentery; the disease if neglected is often fatal, and ulceration, particularly of the ascending colon, is usually present. It is of more importance to determine if possible the causal agent, as the prognosis and probable complications depend on this and, to some extent, the treatment.

As regards the first group of cases the chronic condition is usually the result of too short a course of treatment in the acute stage or to too early a return to an ordinary diet. In many cases alcohol, not necessarily in excess, will produce the same result. Excess of food or exercise, or chills are often responsible for the occurrence of the chronic condition, and acute intercurrent diseases, such as malaria, relapsing fever and even influenza, may bring on a relapse of a chronic or even of an acute type.

In cases where the ipecacuanha treatment fails or is only partially successful, and which are followed by the chronic condition, enemata may be of great value. A large wash-out of 1 to 2 pints of carbonate of soda solution, (10 gr. to the ounce), should be given, and followed shortly after by an injection of a stimulating solution of nitrate of silver ($\frac{1}{4}$ to $\frac{1}{2}$ gr. to the ounce), or copper sulphate ($\frac{1}{2}$ to 2 gr. to the ounce). This injection should be given very slowly with a long soft tube and the patient in the genupectoral position. He should be encouraged to retain it as long as possible. These injections may be given on alternate days.

As a last resource, surgical interference, either colotomy or appendicostomy, may be performed and the bowels irrigated. So many apparently hopeless chronic cases recover under medical treatment that there is a tendency to postpone these useful operations till the patient is too much reduced for them to have any reasonable prospect of success.

Other lines of treatment are adopted by some; amongst these the constant use of salines may be mentioned. It is of less value than in acute dysentery, but is useful.

Quinine should always be given where there is any malaria, but apart from its anti-malarial value injections of quinine given in a similar way to the injections of nitrate of silver are advocated by many, particularly in amœbic dysentery. In these cases the injections should consist of 6 to 8 oz. of a solution of quinine hydrochloride (2 gr. to the ounce) in normal saline. Whichever of these treatments is adopted, constipation must be avoided; as a rule, with 5 gr. of ipecacuanha there will be slight purgation, and with many patients 1, 2 or 3 gr. will be enough to maintain a soft condition of the fæces, which is what it is desired to obtain. When the administration of ipecacuanha is discontinued, constipation (post-dysenteric constipation) is often difficult to deal with. As far as possible it should be treated by changes of diet, aided by small doses (ʒj to ʒij) of castor oil. In many cases ol. olivæ in similar doses will suffice, and a tablespoonful of thick cream is more palatable and often effective. An occasional large enema in obstinate cases is advisable.

In the treatment of chronic dysentery the patient must be kept in bed at first on a milk diet. The milk should be mixed with an equal quantity of barley-water and three to four pints in the twenty-four hours is enough to commence with. The milk diet should not be continued long in cases of relapse, and after three or four days arrowroot, dry toast, rusks or pulled bread may be allowed, and as soon as the diarrhœa has ceased, eggs, boiled white fish, and potatoes, either mashed or baked in the skins, may be given, also custards and milk puddings. As soon as the stools are formed or partially formed, bananas and stewed apples may be added. Shortly after this, fowls, fresh fruit, cauliflower and tender green vegetables may be taken. Beef should not be given whilst there are any symptoms at all, but mutton may be taken when convalescence is fairly advanced.

The use of soured milk in some cases is advantageous, but not in all, and it must be taken very cautiously and only under supervision.

In other forms, and particularly in amœbic dysentery, the onset is so gradual that it becomes a chronic disease without any symptoms sufficiently severe to cause disablement or even serious inconvenience.

Most forms of chronic dysentery are due to protozoa and are therefore not well adapted for treatment by vaccines.

It is not, as a rule, a matter of great difficulty to relieve symptoms; bismuth and opium, copper sulphate and opium and astringents, will frequently check any diarrhœa for a time, but such lines of treatment, in the opinion of the writer, are worse than useless, as the resulting constipation is followed by a severe relapse.

In few diseases is a correct diagnosis of more importance than in dysentery. The prominent symptoms, discharge of mucus with or without blood with straining and frequent motions, may be caused by malignant or tuberculous disease, fistula in ano, or even ulcerated piles, so that a rectal examination in chronic cases should not be neglected.

Verminous infections, particularly schistosomum, bilharzia and other trematodes, may exactly simulate a chronic dysentery, and the symptoms in a case of true dysentery always seem to be relieved by getting rid of any entozoa that may be present. A microscopical examination of the stools for eggs of entozoa should always be made. This examination with a higher power will often enable the protozoa or their encysted forms to be seen, whether these are amœbæ, balantidium or lamblia. It will often be found also that there is mucus mixed up with the stools, indicating an inflammatory action fairly high up. Any worms, such as ascarides, that are present should be expelled with santonin before the regular treatment is commenced.

On the whole, more cases yield to ipecacuanha than to any other drug. Sir Patrick Manson usually puts a patient on a regular course of the drug, beginning with 30 gr. and diminishing by 5 gr. every night, and then keeps the patient on daily 5-gr. doses for some weeks. Others commence with 15 gr. and reduce to 10 gr., keeping the patient on 10 gr. doses for three to five days, and then reducing to 5 gr. and keeping the patient on 5 gr. for a week or more, and then gradually reducing the dose still further to 1 or 2 gr. daily and continuing with these doses for two or three months. If there is constipation, the dose should be slightly increased, or aided by the action of minute doses ($\frac{1}{12}$ to $\frac{1}{8}$ gr.) of calomel and euonymin. This will usually suffice. A rectal injection is given daily by some, but is not advocated by the writer. Many native drugs are largely used locally, such as bael fruit, infusion of the skins of the mangosteen, etc. These substances (when they are freshly prepared), and decoctions from them, are of distinct and sometimes of great utility. The dried preparations or the extracts and tinctures do not give any better results than several of the pharmacopœial astringents.

Of other drugs that have been used, as with most rather intractable diseases, the number is very large. Sulphur, intestinal antiseptics, such as creosote (1 min. every four hours), beta-naphthol (5 to 10 gr.), salol, cyllin and kerol in capsules (10 min.), izal (10 to 15 min. three times a day), etc., have all been advocated from time to time, but are not in general use.

Many patients do not recognise they are suffering from dysentery, as there may be no visible blood and the loose stools conceal the mucus which is being passed. As a general rule, a chronic diarrhœa in a person from the tropics who has had dysentery, even if not severe, is due to chronic dysentery.

Some of the protozoal infections of the intestine, especially with *Lamblia intestinalis*, are closely related to chronic dysentery. In these infections intestinal antiseptics are of considerable value, especially beta-naphthol in 6-gr. doses every four or six hours. The recognition of the condition is of importance, as strict diet is not required, and though the disease is troublesome and recurs after apparent cure it is less dangerous than true dysentery.

Castellani advocates treatment with methylene blue both by mouth and by enemata. He gives large enemata (3 pints of 1 in 3,000) methylene blue twice a day and 2 gr. of methylene blue in cachets or pills by the mouth.

A convalescent patient should be warned not to inspect his stools closely. For years, whenever there is any constipation, there will be some mucous discharge, but as long as the patient is feeling well and the stools are nearly formed, this mucus is of little importance, whilst where these constant inspections are made many people become definitely hypochondriacal.

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EPIDEMIC GANGRENOUS PROCTITIS.

The treatment of this condition is by no means satisfactory.

Dr. Ackers, of Curaçoa, states that the treatment adopted by natives for animals—which also suffer from this disease—is firstly to give a purge, preferably of castor oil, then after this has had an effect to give enemata of lemon-juice, rum and water two or three times a day. White rum is diluted freely with water, and then this is added to strong lemon-juice. Wood ashes should also be freely dusted about the anus and charcoal powder introduced up the rectum. For children the following treatment is usually employed: A decoction of a herb, *Spigelia anthelmintica*, is given by the mouth three or four times a day, and at the same time frequent enemata of the juice of the same plant are administered. Another procedure is to roast a quarter of a lemon and then to introduce this as a suppository once or twice a day. According to Davidson, *matico* infusion by the mouth and rectum was found to be of value in the treatment of a malignant hæmorrhagic dysentery occurring in Trinidad, which was supposed to be similar in nature to the disease under discussion. In these cases lime-juice enemata were also found to be of service. It is difficult to understand how any of these so-called remedies can be of any value if gangrene is far advanced. A more rational form of treatment would be the use of antiseptic solutions as enemata in the early stages, and astringent washes or powders at a later stage. In the later stages excision of the rectum might be tried, especially if the disease is really limited to that part.

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HILL DIARRHŒA.

MILD cases of this troublesome complaint may be treated without going to bed, but patients should be specially cautioned about over-exertion and chills. In more severe cases it is better to put the patient in bed and to keep him there for a week or ten days. **Diet** is a matter of the greatest importance in the treatment; it should always be of the simplest nature and should consist chiefly of milk, the latter commodity constituting the entire menu if the trouble shows no signs of abatement, or if it was severe from the start. The plan adopted of giving the milk as in sprue may be roughly followed. Not more than 3 pints a day should be taken to start with, and this amount increased by 6 oz. every two days until 6 or 7 pints is reached. By the end of this time, if all goes well, a very simple mixed diet of white meat and milk may be tried. It is a good plan to peptonise the latter. When the patient is ready to be about again he should be very warmly clad, and should avoid fatigue and carefully limit his exercise and work. Alcohol is prejudicial, and should either be stopped altogether or used sparingly. Rich and highly spiced foods must be avoided after recovery, as a continuance of a simple diet is necessary if a relapse is to be prevented. Of drugs, Macleod[1] condemns astringents as being harmful; opium, he says, stops the looseness for a time, but it invariably recurs; while cholagogues are equally useless. On the whole, the treatment recommended by Crombie[2] has been found to be the most serviceable. He gave his patients a teaspoonful of liquor hydrargyri perchloridi fifteen minutes after food, and then followed this up by a 12-gr. dose of lactopeptine, pepsine or ingluvin two hours later. In addition, diet was carefully attended to much on the lines described above. Macpherson also had good results with the perchloride treatment. Other intestinal antiseptics might be tried: cyllin, salol and naphthol, for example. All are agreed that, if treatment produces no beneficial results and the tendency of the malady is to become chronic, the patient must leave the hills and return to the low country. Such individuals, and also those who always have attacks of hill diarrhœa on going to the hills, should avoid these localities, because in some instances proper sprue has appeared to follow repeated attacks of this disease.

G. C. LOW.

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[1] Macleod, Col. K., I.M.S., article on "Hill Diarrhœa," Allbutt and Rolleston, "System of Medicine," 1907, Vol. II., Part II., p. 567.

[2] Crombie, Lieut.-Col. A., Indian Medical Gazette, Calcutta, 1892, XXVII., p. 129.

INFANTILE BILIARY CIRRHOSIS.

The treatment of infantile biliary cirrhosis, a disease attacking children in Calcutta and other parts of India, is still uncertain. This must necessarily be so until more is known about its etiology. As the condition usually attacks children, chiefly under one year of age, a sensible procedure is to remove the child from its mother and to give it to a wet nurse to suckle. On the other hand, if the infant has already been in the care of a wet nurse, a change to another should at once be made, and the greatest care taken to ensure that the latter is healthy in every respect. Wherever possible, the child should be removed at once from the endemic area, and in the case of older children, two to three years, all food should be changed and the source of the milk supply carefully investigated.

Milk should constitute the staple diet, even in older children ; though in certain instances farinaceous puddings may also be allowed. Of drugs to act on the liver, sulphate of soda or magnesium, calomel and euonymin are worthy of a trial, while as tonics nux vomica and dilute nitro-hydrochloric acid in suitable doses may be mentioned. If ascites develops this may first be treated by diuretics or copaiba. Failing relief by drugs, paracentesis, especially if the distension is extreme, may have to be carried out. Malaria and syphilis are not supposed to play any part in the etiology of the condition, but if present will, of course, have to be treated.

G. C. LOW.

LIVER ABSCESS (*See* Vol. II.).

PONOS.

UNTIL the etiology of this disease is placed on a more certain foundation[1] treatment must be tentative. Davidson,[2] and more recently Williamson,[3] have suggested that the Leishman-Donovan parasite, or some similar protozoan, may be the responsible agent, and colour is lent to this idea by the recent work of Nicolle in Tunis. This latter observer has shown that a disease, which clinically answers in some respects to ponos, occurs in children in that place, and that splenic and hepatic punctures yield protozoal parasites apparently identical with the bodies found in Kala-Azar. In view of the possibility of such an etiology turning out to be correct for ponos, treatment would naturally divert itself into the two main channels of prophylaxis and cure.

Prophylaxis.—Bugs, lice, fleas and other insects must be scrupulously destroyed, and houses kept clean and well ventilated. The destruction of bugs or the prevention of their access to houses is said to have been responsible for a diminution of cases of Kala-Azar in Assam, and if such is the case, the method can easily be applied elsewhere. New buildings should always be constructed with a view of preventing the invasion of such parasites.

Children in infected areas should also be made to sleep under mosquito nets, as this, in addition to the prevention of mosquito bites, also affords a degree of protection against bugs. Premature weaning and protracted lactation are said to dispose to the disease; but anything that debilitates the infant is equally likely to render it susceptible to a parasitic invasion, and should, therefore, be avoided.

Poultry and animals, such as sheep, goats and pigs, should be rigorously excluded from houses; they may not in themselves produce disease, but it is quite possible that their parasites—ticks or otherwise—might do so.

Treatment.—Many drugs have been tried in the treatment of ponos, but apart from ameliorating symptoms in some instances they have not done much good, and have not prevented death from taking place. Thomopoulos has found this to be the case with quinine. Arsenic does not appear to have been given, and this is rather peculiar when one considers its general use throughout medicine. A treatment by arsenic or by the arylarsenates should certainly be tried, especially in view of the ideas on the etiology of the disease just stated. Soamin, orsudan, atoxyl, or arsacetin may be employed; care should, however, be exercised in giving any of these, as cases of blindness have unfortunately followed their use. In addition to this the child's strength should be built up as far as possible by good food, cod-liver oil, tonics and plenty of fresh air. Davidson recommends iodide of iron as a tonic, and believes that bone-marrow might be worthy of a trial. If syphilis is present in the parents or in the child, a mercurial treatment should be used alternately or in conjunction with the arylarsenate. Removal from the house where infection took place to a hospital or other healthy building is also indicated.

G. C. LOW.

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[1] NOTE.—Since this article was written *Leishman-Donovan* parasites have been found in cases of ponos.

[2] Davidson, Andrew, article on "Ponos," Allbutt and Rolleston, "System of Medicine," 1897, Vol. II., Part II., p. 606.

[3] Williamson, G. A., British Medical Journal, 1909, II. p. 781.

SPRUE.

SPRUE, although essentially chronic and progressive in type, is by no means an intractable affection. Marked improvement usually follows timely treatment; and, even when the disorder has reached an advanced stage, restoration to permanent health is by no means infrequent. On the other hand, the inevitable result of neglect or carelessness is a condition of chronic invalidism which almost invariably terminates fatally.

At all stages of the disease diet is of pre-eminent importance, and success practically depends on the food being adapted to the altered assimilative capacity. Further, as impairment of metabolism manifests itself chiefly in failure of carbohydrate digestion, strict limitation of starch-containing elements is the cardinal principle in the dietetics of sprue.

Milk Diet.—The indications for initial treatment are generally best fulfilled by placing the patient on a diet consisting solely of cow's milk; and in suitable cases no other food should be allowed for at least three weeks. Certain precautions are, however, necessary. As a preliminary measure, the alimentary tract must be thoroughly cleared of undigested and fermenting refuse by a full dose of castor oil, the patient must be kept at rest in bed, and the milk must be given at carefully regulated intervals and in definite quantities. A usual method is to fix the duration of a milk diet at twenty-four days, and to divide that term into six periods of four days, the quantity of milk being increased with each period. For the first four days 60 oz. daily are given; for the next four days 70, and so on, until a maximum of 120 oz. is reached. Not more than 2 or 3 oz. of milk should be taken at a time, and it should be slowly sipped or sucked through a straw. Although milk may be warmed in cold weather it should never be boiled or sterilised by heat. When the excess of fluid irritates the stomach evaporated or concentrated milk may be employed, but the change is seldom successful, and in such circumstances, it is generally advisable to order a meat diet at once. Dilution with barley-water or peptonisation may, on the other hand, obviate difficulties due to the inadequate digestion of casein.

When nothing but milk is being taken, exertion is impossible and fatigue may be dangerous. Faintness is often induced by walking upstairs or by a warm bath, and in no case should a patient be allowed to bathe unattended. Alcoholic drinks of all sorts are specially contra-indicated.

The first effect of a milk diet in sprue is an augmented loss of flesh, but at the end of a week or ten days the weight generally begins to increase, diarrhœa ceases, toxæmia disappears, and lassitude and exhaustion give place to a sense of "fitness" and *bien-être.* The dejecta, however, are larger and more bulky than ever, and fæcal pigment, the most reliable indication of convalescence, seldom reappears until after several weeks.

Soured Milk frequently proves effective in the treatment of sprue when fresh milk by itself is found unsuitable. It should be prescribed as an adjunct to an ordinary light diet of which milk, fruit and sugar are the chief constituents. Milk fermented by dried cultures of the bacillus of Massol is unreliable; but most of the principal dairy companies now provide daily supplies of soured milk freshly prepared with proper precautions from recent and active cultures. If used in accordance with directions, "wet" cultures are generally trustworthy.

Fruit in Sprue.—Even in cases where it would appear probable that fruit of any sort would be likely to induce dangerous diarrhœa, the addition of considerable quantities of fruit to a milk diet is often followed by remarkable improvement. Certain subacid fruits, indeed, undoubtedly possess definite curative properties, and although many varieties may be used with success in the treatment of sprue, strawberries almost invariably give the best results. When obtainable, they are usually prescribed in the following way: After the patient has been confined to milk for four or five days, and when the more prominent symptoms of digestive inefficiency and disturbance have subsided, ¼ lb. of crushed strawberries with sugar and cream is taken three times a day in addition to the milk diet; and this quantity is gradually increased until a daily allowance of 2 or 3 lb. is reached. The acidity and freshness of the fruit are the important principles, and strawberries should always be newly gathered and not over-ripe. Jam and other preserved preparations are useless; but when fresh strawberries are unprocurable, grapes, bananas, cranberries, or oranges may be substituted. These fruits, however, are distinctly inferior to strawberries both in nutritive value and in therapeutic action.

Meat Diet.—If milk is badly tolerated or if it fails to have the desired effect, a diet of meat to the exclusion of all other foods almost invariably gives good results. Meat has, indeed, certain definite advantages over milk; it is easily assimilable, the residuum more closely resembles the natural dejecta, and it is less likely to cause constipation. On the other hand, a diet composed solely of flesh soon becomes intensely nauseous, and it is difficult to continue meat alone for more than a few days. In sprue, however, distaste for meat is generally less marked than it is in health. Only beef, mutton, and chicken or game should be used; veal is apt to cause diarrhœa, and pork in any form is inadmissible; glandular tissues, such as kidneys and salted or preserved meat, should also be avoided.

Provided that it is lightly but sufficiently cooked, meat may be prepared almost in any way which suits the taste and digestive capacity of the patient. About 2 lb. (raw weight) can be taken every twenty-four hours by a man of average build, and this quantity may be continued as the sole food for eight or ten days. After that time it is advisable to modify the exclusive character of the food, and once or twice daily lightly-boiled eggs or fish with a little macaroni or a few rusks should be given. During a *régime* of meat, hot water, toast infusion, barley-water and similar diluents, should be drunk freely, and an orange or a few grapes may prove useful and agreeable adjuncts to the diet.

Medicinal Treatment.—The type and general course of the disease remain almost entirely uninfluenced by the administration of medicines. Many drugs are actually deleterious, and several of the remedies which are naturally among the first to be prescribed, such as bismuth, the mineral acids, iron and arsenic, invariably do harm. Astringents must also be used with great caution; they are admissible only when diarrhœa results from loss of tone in the intestinal muscle, and should never be given to check the lienteric flux which is characteristic of sprue and which is the result of atrophy and degeneration of the intestinal structures.

It is, however, necessary to treat urgent symptoms as they arise, and marked relief is often afforded to some of the more distressing manifestations of the disorder by the use of intestinal antiseptics. Of these the most reliable are lactate of calcium (3 gr., in cachet, six or eight times daily); benzosol (5 gr., four or five times daily); and thymol in combination with menthol. Keratin-coated capsules, each containing 2 min. of oil of cajuput, ½ gr. of menthol, ½ gr. of thymol, 1 min. of pure chloroform, and 1 gr. of the oleo-resin of capsicum, are specially useful in checking alimentary fermentation and putrefaction. Experience of salol in sprue is unfavourable, and free chlorine has little if any beneficial influence. Yellow santonin (5-gr. doses, suspended in 1 oz. of olive oil, and given night and morning for a week) has proved successful in certain cases, but the claims which have been made for its specific action have not been endorsed by general experience. The promotion of efficient digestion and regular action of the bowels are by far the most important factors in controlling intestinal sepsis; and during treatment by non-putrefactive diets and remedies occasional doses of castor oil or Carlsbad salts are generally advisable. Vegetable bitters and antiscorbutics, such as simaruba, bael fruit, and kola, may be of some assistance in increasing digestive capacity.

Complications and collateral infections must be treated as they arise. Choleraic or dysenteric diarrhœa is generally relieved by absolute rest in bed, by limitation of the diet to raw meat juice and barley-water, and by the administration of small doses of liquor opii sedativus, with or without castor oil. Demulcent enemas of starch or gum arabic with laudanum, and the application of turpentine stupes to the abdomen, may also prove useful. Impending collapse should be prevented by warmth, friction and the hypodermic injection of 5 min. of a 1 per cent. solution of strychnine hydrochloride. The persistent hiccough of sprue is often effectively relieved by 1 min. doses of liq. trinitrini (1 per cent.) [U.S.P. spiritus glycerylis nitratis] repeated every hour; and threatened meteorism may be averted by asafœtida in full doses with copious enemas of warm saline solution.

Local Treatment.—Special attention to the hygiene of the teeth and mouth is always necessary. After food the buccal cavity should be rinsed with diluted borax and glycerine (ʒj in ℥x), or solution of peroxide of hydrogen (ʒij in ℥x). Sensitive and ulcerated patches should be brushed over with solution of cocaine (10 gr. in ℥j), and afterwards pencilled with nitrate of silver in solution (½ to 1 per cent.). Eczema of the nates is best treated by frequent washing with weak solution of permanganate of potash, followed by the application of an emollient ointment. A suitable formula is: ℞. Orthoform, gr. 40; Zinci Oxidi, gr. 120; P. Amyli, gr. 120; Paraffini Moll., ℥j.

Convalescence.—The dietetic and general treatment of sprue must be continued long after active symptoms have disappeared. Carbohydrate food should be permanently limited in quantity, and the diet ought to consist principally of fresh meat, fish, eggs, milk, cream, green vegetables and fruit. Salted, pickled or preserved meat, and highly-seasoned dishes should be forbidden. At all stages of the disease alcohol is prejudicial, and during convalescence abstention is especially desirable. In temperate climates cold is an even more frequent cause of relapse than dietetic indiscretion, and it is imperative to take unusual precautions against chill. The hands and feet are particularly susceptible to cold; and motoring, fishing and other recreations which entail prolonged exposure, should be permanently avoided by sprue patients.

W. CARNEGIE BROWN.

INFECTIVE GRANULOMATA.

LEPROSY.

No chronic infection is less amenable to treatment than leprosy; and, although, in rare instances, recovery undoubtedly takes place, the disease terminates fatally after a duration of from five to fifteen years in 95 per cent. of all cases. Prophylactic and individual remedial measures are, however, always urgently demanded in order to prevent contagion, to alleviate the sufferings of the patient, and to enable him to escape the repulsive disfigurements and mutilations which are inevitable complications of neglected leprosy.

Prophylaxis.—Heredity, food intoxications, and other theories of origin have of late years been discredited, and the propagation of leprosy is now believed to depend solely on direct infection by a specific bacillus, of persons who are predisposed to infection through grossly unhygienic conditions of life. It follows that, in districts where leprosy is endemic, cleanliness and the general promotion of public health are the first essentials to the repression of the disease, and that modern methods of sanitation must always be rigorously enforced. Further, as leprosy is certainly, if tardily, conveyed from infected to uninfected persons, isolation is rightly considered necessary for the public safety; and since the drastic sanitary laws of the Mosaic era, enactments for the removal of lepers from their families and their confinement in asylums have been generally enforced by most civilised communities. In many British tropical dependencies, however, compulsory segregation is now applicable only to indigent and helpless lepers; and provided they do not frequent public places, intelligent patients, if under treatment and supervision, are allowed to remain in their own homes.

Ascertained routes and methods of infection are the naso-pharynx (by bacillus-carrying mucus), the mucous membrane of the mouth (by contaminated vessels, suckling, etc.), the genital tract (by infected secretions), actual inoculation through the skin (by needles, instruments, etc., possibly, also, by blood-sucking insects); and special precautions to meet these possibilities are necessary. Excoriations and ulcers of the mucous membranes should be disinfected and dressed; utensils, etc., used by lepers should be sterilised; marriage should be prohibited; and in endemic centres suckling by native wet-nurses and arm-to-arm vaccination, although foster-mothers and lymph-giving infants appear perfectly healthy, should be forbidden.

Even in Great Britain and other places where leprosy shows little tendency to spread, known lepers should on no account be allowed to associate or mix with the general community; and strict regulations to prevent the maritime importation of cases into all uninfected countries are absolutely necessary. A ship bringing a leper to any port of the United States is refused pratique until the patient and his baggage have been placed in quarantine where he is maintained and treated at the expense of the owners, the vessel being further compelled on her departure to the port of shipment, to take the leper back. The rule, although stringent, is by no means unnecessarily harsh; and it might well be adopted by other countries.

The isolation of lepers presents problems of great difficulty. Small islands make the best asylums. When fit for light work the patients should be kept employed, but confinement in a segregation colony should have as few as possible of the other characteristics of prison life. Many things which are most easily made by hand, such as matting, basket work, etc., are liable to carry infection, and it is undesirable that these and other articles for domestic use should be made by leper patients. As a rule, lepers may be employed in kitchen gardening, but vegetables and other produce raised in this way are obviously unfit for consumption except in the asylum itself.

General Treatment.—In the absence of any known means of arresting the progress of the disease, the modern treatment of leprosy is limited to endeavours to improve the hygienic and general condition of the patient, to relieve pain, to control tissue destruction, and to counteract the consequences of secondary septic infections.

Before even the smallest measure of success in the treatment of leprosy can be attained, it is essential that the hygienic surroundings of the patients should be placed on a satisfactory basis. Whether they are cared for in an asylum or not, persons affected with the disease must be removed from all insanitary influences; their food should be the best that, in the circumstances, is procurable; they should live, as far as possible, in the open-air; and they should have abundant opportunities for cleansing themselves. Frequent bathing invariably produces and maintains a feeling of comfort and relief; and, in some cases, high-temperature baths (100° to 105° F.) seem to be of actual service in checking the progress of the disease. In Europe saline, ferruginous, and arsenical natural baths, and in Japan and the Eastern tropics sulphurous volcanic springs have been specially recommended; but in warm countries sea bathing once or twice daily is at least equally efficacious.

The diet must be liberal and should contain a large proportion of fat. Native patients, when they first come under treatment, are in most cases greatly emaciated, and the addition of considerable quantities of oil, butter, ghee, or animal fat to their ration is a necessary preliminary to other palliative measures.

Medicinal Treatment.—Infallible virtues have from time to time been claimed for an innumerable number of different remedies, but when subjected to careful clinical investigation practically all of them have failed to maintain their reputation for efficacy. Yet, although no known medicine possesses specific properties or affords a definite prospect of curative action when leprosy is once established, therapeutic remedies should not be discarded. One or two drugs which were originally introduced as empiric cures, undoubtedly exercise a certain beneficial and alterative effect and are still largely employed in the medicinal treatment of the disease both by European and native physicians.

Chief among these is chaulmoogra oil (oleum gynocardiæ), which is expressed from the seeds of *Gynocardium prainii*, a well-known Indian tree. The oil is used for internal, for hypodermic, and for external medication, and is a powerful but somewhat repellent remedy. It is therefore necessary to begin with small doses; at first only five to ten drops are given morning and evening, the quantity being increased as rapidly as possible, until at least ½ oz. is taken daily. To secure the alterative effects of chaulmoogra oil it must be continued for some months, during which time the diet should consist almost entirely of milk. The disadvantages of the drug are that it is often badly tolerated, and that it occasionally induces severe diarrhœa and vomiting.

After sterilisation by heat chaulmoogra oil gives rise to little or no irritation when used hypodermically, and daily subcutaneous injections (5 c.c. each) continued for several months have been followed in many instances by marked improvement. It has also been employed with advantage as a rectal injection (5 c.c. in milk), and as a pomade (chaulmoogra oil, 4; soft paraffin, 6; hard paraffin, 1).

Other alteratives for which special efficacy has been claimed are: Gurjun oil (a viscid balsam obtained from the East Indian tree, *Dipterocarpus turbinatus*), arsenic, ichthyol, europhen and hydrarg. perchlor.; but, although slight improvement occasionally results from their use, personal experience fails to endorse the view that these remedies are of real utility in the treatment of leprosy. Arsenic, given for protracted periods in gradually increasing doses until distinct symptoms of arsenical intoxication were produced, appeared in some instances to check the formation of new lesions; but in no case was the progress of the disease permanently arrested, nor was a fatal issue averted. Soamin and other organic preparations of arsenic are now being extensively tried, but there has been insufficient time to judge of their merits. The successes reported by Crocker and Hutchinson to have resulted from prolonged courses of perchloride of mercury, given hypodermically, have not been attained by other physicians; and similar failures have to be recorded from the use of ichthyol and europhen, which were found efficacious by Unna, Goldschmidt and Gruenfeldt.

Alterative remedies, moreover, appear to be entirely ineffective in anæsthetic leprosy, a condition which, however, is sometimes ameliorated by tonic and strengthening treatment. In suitable cases the administration of iron, quinine, and arsenic by the mouth and hypodermic injections of arsenate of soda with iron or cacodylate of iron occasionally effect considerable improvement in the general health. The severe attacks of neuritis in invaded nerves which are so frequent in this form of the disease may be temporarily relieved by full doses of aspirin or antipyrine. Suitable formulæ for hypodermic injections are: (1) ℞. Sodii Arsenatis, gr. 6; Ferri et Ammon. Cit., gr. 60; Aq. Dest., ad ℥iij (♏5 to 15); (2) ℞. Ferri Cacodylat., gr. 10; Aq. Dest., ad ℥iij (♏5 to 15).

During the progress of leprosy opiates are generally necessary, and in most cases the frequent administration of morphia and other preparations of opium is justifiable. In sedative action on the nervous system, and in the relief which it affords to depression and melancholia, no remedy approaches opium in value; and, in the case of Asiatic patients who are accustomed to its use, refusal to sanction a regular allowance of the drug is almost invariably followed by intense excitement and suffering and by a marked aggravation of the other symptoms.

Surgical and Local Treatment.—It is generally believed that the development of systemic leprosy is preceded by a primary lesion, which appears as a macular tubercle at the site of infection; and many physicians regard early excision of this initial leproma as an essential step in the abortive treatment of the disease. Personal experience indicates, however, that leprosy does not usually commence in this way; a primary lesion is seldom or never seen, or, at all events, patients rarely apply for treatment before they exhibit further manifestations of infection. In any case it is questionable whether its removal would be more effective than excision of the primary sore of syphilis. Destruction of the tuberous nodules in the cutaneous tissues by compression and cautery as practised by Unna and other authorities, offers no prospect of radical cure, and entails so much suffering that it appears to be an entirely unjustifiable method of treatment.

The prevention of septic infection is of special importance, and it is unnecessary to say that all surgical procedures, from the dressing of ulcers to the amputations which may be required in the later stages of the disease, should be carried out as far as possible on antiseptic lines. There is no doubt also that free irrigation of the upper air passages by boiled water and weak solutions of boric acid or listerine has a marked influence in checking the tendency to ulceration and necrosis of the nasal and pharyngeal tissues. After copious douching, a liberal supply of a pomade consisting of soft paraffin 1 oz., menthol 2½ gr., and boric acid 30 gr., should be introduced as far as possible into the nostrils. Inhalations of eucalyptus, turpentine or cajuput vapour may also be used with advantage.

Free lubrication of the face and hands with Lassar's paste (equal parts of zinc oxide, starch, soft paraffin and lanoline) is said to prevent the formation of leprous exanthemata, and endeavours are sometimes made to reduce swellings already formed by inunctions of chrysophanic or pyrogallic acid ointments. Personally, I have never seen any appreciable diminution follow abortive local treatment, and the application of counter-irritants to tissues strongly predisposed to ulceration appears to be unscientific and unsafe. The X-rays have also been employed for the same purpose, and in some instances temporary improvement has followed their application. No permanent arrest of the morbid process has, however, been effected.

The Serum Treatment of Leprosy.—Announcements of the discovery of a curative serum have from time to time been made by different observers, but these claims remain almost entirely unsupported by independent investigation, and the serum-therapy of leprosy has proved even less effective than the treatment of the disease by empiric remedies. The specific bacillus has hitherto resisted all attempts at artificial cultivation, and the various antitoxic products obtained from reputed cultures and affected tissues have, so far, completely failed to exercise any influence on the extension of the lesions or the duration of the malady.

The Nastin Treatment of Leprosy.—A certain amount of success, however, appears to have been attained in certain cases by a system of inoculation, recently introduced by Professor Deycke, of Constantinople, which is now generally known as the Nastin treatment. The method is based upon a claim that a characteristic microphyte (*Streptothrix leproides*) may be isolated from the affected tissues of nodular leprosy, and that in certain rapidly progressive cases hypodermic injections of living cultures of this organism were followed by remarkable retrogression of all the symptoms. Further experiments led Professor Deycke to the conclusions that a neutral fat, contained in the growth and named by him "Nastin," was the carrier of the active principle of antagonism to the *Bacillus lepræ*; that its efficacy could be greatly increased by conjunction with benzoyl chloride; and that the combination of the two substances killed the lepra bacillus by depriving it of its contained fat, thus leaving it an easy prey to the protective action of the leucocytes.

The possible significance and importance of Deycke's observations have been greatly enhanced by the fact that his results were almost immediately confirmed by several independent observers; but it must be remembered that temporary remissions are characteristic of the natural progress of the disease, and that they are an almost invariable consequence of the improved hygienic conditions in which a patient selected for special treatment is placed. The question of the possible relief of leprosy by Deycke's method is in fact still *sub judice*. The profound importance of the subject makes further investigation imperative, but in the meantime it must be admitted that recent researches by Lenz,[1] in Central Africa, by Heiser,[2] in Manila, by Brinckerhoff and Wayson,[3] in Hawaii, and by Ashburton Thompson,[4] in Sydney, have seriously discredited the accuracy of Deycke's deductions and the success of the Nastin treatment.

Since the middle of 1910, dioxy-diamido-arseno-benzol (Ehrlich's 606) has been frequently used in the treatment of leprosy, and in most instances the use of the drug has been followed by encouraging results. There has been insufficient time, however, to form a reliable opinion as to the permanent efficacy of the remedy.

Montel has recently shown that in advanced cases of leprosy great benefit sometimes accrues from the hypodermic injection of a 10 to 20 per cent. suspension of iodoform in olive oil. About

2 c.c. are injected daily into healthy tissue surrounding the larger lepromata, the position being changed each day until a complete circle has been made.

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ORIENTAL SORE.

Prophylaxis.—Although it is now established that infection by Helcosoma tropicum or some allied species of the Leishman-Donovan parasite is the invariable cause of Oriental sore, little is known of the routes of transmission or even of the sources of contagion. It is, however, probable that the disease is conveyed from infected persons or animals by insects, and in endemic centres systematic precautions against bites and stings are advisable. Special attention should be paid to domestic cleanliness, and places where flies and other insects are likely to breed should be regularly cleansed and disinfected. The parts of the body which are generally clothed appear to be unusually liable to attack if exposed, and during the day only the face and hands should be uncovered. At night mosquito curtains of sufficiently small mesh to prevent the entrance of sandflies and other minute insects, should be used. Dogs often harbour the specific parasite in enormous numbers, and very probably are a frequent source of infection. They should be carefully looked after, and all vagrant dogs, especially those which have open sores, should be destroyed. In places where Oriental sore is prevalent travellers are generally told that infection occurs only at certain seasons of the year, but little credence should be given to popular statements and beliefs. Oriental sore is protective against itself, that is to say, the development of the disorder confers permanent immunity from future recurrence. It therefore appears probable that a method of immunisation and, possibly, of cure, applicable not only to this condition but to the nearly allied and extremely fatal disease, kala-azar, may be found in the use of protective sera; but unusual difficulties have been experienced in infective inoculation, and so far no curative vaccine or serum has proved successful. In Asia Minor many of the inhabitants consider the chance of escape from infection so slender that in order to avoid permanent disfigurement by scars on the face they inoculate their children on some part of the body which is usually concealed by clothes.

General Treatment.—This is, to a great extent, expectant. The disease is a constitutional one and cannot be cured by disinfection, destruction or excision of the sores. So long as the parasite is active the distinctive granuloma, if removed, recurs at the same place or reappears in other positions; but when it has exhausted its virulence and reached the involution stages the ulcers heal of their own accord. The period of activity generally lasts for about a year, and mercurials, iodides and other systemic remedies, have no effect in shortening the duration or modifying the type of the infection. Still less benefit is to be anticipated during the active phases of helcosoma from the employment of energetic local measures. Cauterisation, scraping, exposure to Finsen and X-rays, injections of methylene blue, and Bier's method of treatment are invariably followed by violent inflammatory reaction in the earlier stages of the disease, but they are innocuous and sometimes even apparently curative when it has run its course. Except that they are harmless at all periods of the infection, the same criticism applies to the use of flattened bullets and other nostrums which are popularly vaunted as specifics. Until the involution phases are reached no result follows their application; when the parasite ceases to be active spontaneous cure takes place.

As a rule, the best results are obtained by systematic cleanliness, the application of emollient and sedative ointments or dry dressings to the sores, the provision of a nourishing and generous diet, and the regular administration of Easton's syrup or some other tonic. In cases where there is marked debility and anæmia a change of climate is advisable. Dry and hardened discharges should be removed by the use of warm boracic acid lotions (2 gr. to the ounce), and the subsequent formation of crusts should be prevented by frequent washing and dressing. The application of solution of cocaine (5 per cent.) may be necessary to relieve acute pain, but in most cases the following ointment acts as an efficient sedative: ℞. Orthoform, gr. 40; Paraffin. Moll., ℥j. When the ulcers become callous, dressings of liquor hydrogen peroxid. (B.P.) (ʒij with Aq. ℥x) prevent fœtor and frequently induce the formation of healthy granuation tissue. A powder composed of boric acid 1, zinc oxide 3, and starch 3, is an excellent absorbent, and at the same time affords marked and immediate relief to the intolerable itching and irritation which are often the most persistent and distressing characteristics of the disorder. Benoit[1] and de Beurmann[2] have recently obtained good results in severe cases of Oriental sore by the following treatment: The ulcer is thickly dusted with permanganate of potash in very fine powder, and, after eight or ten days, the crust which forms as a consequence of the application is removed, and the open sore is dressed daily with a 10 per cent. solution of methylene blue. A serious objection to this method of treatment is the severe pain which is caused by the permanganate. Whichever line of treatment is adopted, the open sores should be covered with cotton-wool or gauze, and in the intervals of dressing they should be kept closely bandaged and protected from the air.

W. CARNEGIE BROWN.

REFERENCES.

[1] Benoit, Archives de l'Institut Pasteur de Tunis, 1907, p. 130, and Presse Médicale, Paris, 1907, XV., p. 341.

[2] de Beurmann, Revue de Médicine Tropicale, 1910, VII., 4.

ULCERATING GRANULOMA OF THE PUDENDA.

The etiology of infective granuloma, or as it is more frequently termed, ulcerating granuloma of the pudenda, is still imperfectly understood. The morbid process is variously regarded (1) as being akin to that of carcinoma, (2) as a consequence of contracted or inherited syphilis, (3) as a purely local neoplasm originating in some bacterial infection of the skin or mucous membrane, but the results of treatment indicate that the pathology of infective granuloma is in all probability complex, and that the condition is due to more than one pathogenic agency.

The Constitutional Treatment, therefore, varies. In some instances the connection between infective granuloma and syphilis is clearly traceable; and in such cases, although mercury is useless, large doses of iodide of potassium are generally followed by marked and immediate improvement. On the other hand, in the great majority of instances, alterative and specific remedies prove entirely unavailing. Systemic treatment, however, should not be neglected. The subjects of the disease are always much emaciated and marasmic, and in many cases arsenic, iron, cod-liver oil, malt, phosphates and quinine arrest the spread of the proliferations and promote a tendency to cicatrisation. A liberal diet is essential.

Local Treatment.—The only local treatment which offers a definite prospect of success is complete eradication of the neoplasm. If it can be caught in the earliest stage of development, this is possible; and free excision of the new growth together with the subjacent connective tissue may result in the formation of a healthy scar, followed by permanent arrest of the morbid process. At a more advanced period simple excision of the nodular mass is seldom effective, and recurrence is almost invariable. In such cases, however, the energetic use of the sharp spoon, combined with the application of escharotics, may still succeed when milder measures fail. A compound of zinc chloride 4, solution of chloride of antimony 2, starch 1, and enough glycerine to form a paste, is an effective caustic, but one which must be employed with circumspection. Bougard's paste is generally used in French tropical settlements and is said to give good results. It is prepared by mixing wheat flour and starch, āā 120, with arsenious acid 2, mercuric sulphide 10, ammonium chloride 10, mercuric chloride 1, and adding enough of the official liquor zinci chloridi to form a thick paste. Zinc chloride pounded with an equal weight of oil of theobroma may also be moulded into pencils or pastilles for insertion into channels or fissures. Great caution is, of course, necessary in the use of all these applications.

Even when temporary success is attained the probability of recurrence, the size of the wound, and the extent of denuded tissue are serious drawbacks to the effect of these procedures; and although skin grafting has been tried with good results, especially in situations other than the pudenda, radical treatment is generally impossible. Palliative measures, such as the application of sedatives, antiseptics and deodorants, are then indicated. In inoperable cases, poultices of boric acid and charcoal (1 in 8) sprinkled with liquor opii sedativus counteract the offensive smell and relieve the pain of extensive and rapidly disintegrating granulomata. Ointments of oleate of copper (cupri oleat., 1; soft paraffin, 12), or of resorcin (resorcin, 10; zinc oxide, 25; wheat starch, 25; liquid paraffin, 40), to which, if there is pain, pure morphine (1 in 60) should be added, act as efficient deodorants, and further tend to check the activity of the nodular growth. Strong solutions of permanganate of potash (1 in 50), of perchloride of mercury (1 in 2,000), or of lysol (1 in 80), may also prove useful in retarding the proliferation of new tissue and in controlling septic processes.

W. CARNEGIE BROWN.

VERRUGA PERUVIANA.

UNDER the heading of Verruga Peruviana two, probably ifferent, affections have been included, one characterised by the resence of the peculiar eruption of granulomatous swellings, or errugas in the skin, mucous membranes, and internal organs, ith or without fever; and another, which is often fatal, has an ncubation period of twenty-one days, and in which the leading ymptom is fever of the type known as "Carrion's fever." As a result f extensive bacteriological investigations on the subject, Barton as succeeded in isolating from the febrile cases of both types a acillus somewhat similar to the Bacillus coli communis, which is bsent in cases where "verrugas" are present alone. The general onsensus of opinion at present is that the type of case in which an ruption occurs, namely, true verruga Peruviana, is an entity somehat analogous to yaws, but different from it in not being ontagious or due to the Treponema pertenue of Castellani, and that he febrile condition which may complicate the verrugas or occur ndependently of them, and with which Carrion inoculated himself, s possibly due to Barton's bacillus, and is closely related to typhoid ever.

As our knowledge of the etiology of verruga Peruviana is ncomplete, the treatment of it is empirical rather than rational. he only definite prophylactic at present known is the avoidance f the districts in which it is endemic, such as the western slopes f the Andes, but it is hoped that by improved drainage and better anitation of these regions the frequency of its occurrence will be ventually reduced.

The prognosis is invariably uncertain, and should be guarded, as he present mortality is high, varying from 10 to 40 per cent., eath taking place as the result of the presence of verrugas in the nternal organs, anæmia from hæmorrhages, septicæmia, and arrion's fever. Where possible the patient should be removed rom an endemic area to a warm country on the coast, as both cold eather and high altitudes are believed to be unfavourable conitions for recovery. No specific remedy is at present known, and ll that can be done is simply to increase the resistance of the rganism by suitable nourishment and the usual tonic remedies, uch as quinine, iron, and strychnine. Iodide of potassium and injections of arsenic have also been employed, but they appear to be of doubtful value. Where febrile symptoms are pronounced the cases should be treated in the same way as typhoid fever. The natives have used from time to time decoctions of various plants which they believe to have a specific effect on the disease, such as maize, Buttneria cordata (buttneriaceæ), Schinus melle (terebenthinaceæ); but these probably simply act as diaphoretics. They also believe that chills and cold baths should be avoided, as they consider that they do serious harm by preventing the eruption of the verrugas, and so endangering the life of the patient. How far this may be true is uncertain, but it suggests the old fallacy that to cure an eruption is harmful by driving the virus back into the blood. For the actual destruction of the local lesions, which are liable to give trouble from hæmorrhage, the old-fashioned plan of ligaturing the basis of pedunculated lesions may be adopted. When ulceration supervenes it is advisable to bathe the lesions with an antiseptic lotion, such as corrosive sublimate (1 in 4,000), and dress them with ointments containing boric acid or ammoniated mercury.

J. M. H. MACLEOD.

YAWS (FRAMBŒSIA TROPICA).

In the treatment of yaws it is important to remember that there are at least two clinical types of infection, a local and a general. The lesions of the former variety are confined to the spots at which inoculation takes place; they are never followed by constitutional symptoms, and they require little treatment beyond cleanliness and the prevention of secondary pus infections. In such circumstances it is unnecessary and inadvisable to submit the patients, the great majority of whom are children, to specific treatment, and the simplest measures of local disinfection and protection from exposure usually suffice for the cure of the disorder. Systemic or general yaws, on the other hand, is a constitutional disease which, in many instances assumes a type of marked severity, demanding careful dietetic treatment and a prolonged course of specific remedies.

Prophylaxis.—So far as is known, both forms of the disease are almost invariably transmitted by the conveyance of the pathogenic spirochæta from a yaws ulcer to an abrasion on the skin of a healthy person, and in all probability flies or winged insects act as the media of communication. In places where the disease is endemic, therefore, unusual caution is demanded in the care of wounds. Even the smallest sores must be protected from infection, and as young people are particularly susceptible to yaws, the inevitable scratches and excoriations of childhood should always receive prompt attention. Odoriferous antiseptics, such as sanitas, thymol, eucalyptol, chinosol and carbolic acid, are specially effective n repelling insects; and cuts and abrasions should be frequently washed with dilute solutions of one or other of these remedies and afterwards dressed with a weak ointment of similar composition. When the disease has declared itself segregation is imperative, and special precautions should be taken to exclude servants, in whose amilies there may be cases of yaws, from houses and compounds where there are healthy children. Native huts in which infected persons have lived should be cleansed; clothes contaminated with discharges from yaws sores should be scalded or burned, and all refuse heaps and other possible breeding places of flies should be swept away and destroyed.

The expediency of more energetic measures for the suppression of yaws must be decided by local considerations. In some parts of the West Indies the type of the disease is so malignant that compulsory segregation of all yaws patients, the complete isolation of infected houses, the burning of huts in which successive cases have occurred, and strict enforcement of stringent sanitary regulations, are fully justified; but in the Eastern tropics, where the disease seldom assumes a virulent form, less drastic measures are demanded.

Local Treatment.—When crusts have formed they should be removed by a warm dressing of oiled silk and lint which has been soaked in a hot solution of soluble Sanitas oil (1 per cent.), or of chinosol (1 per cent.), carbolic acid (1 per cent.) or thymol (1 in 2,000). Thick and hard epithelium on the hands and feet may also be softened and removed in the same way. Open sores should be washed morning and evening with a lotion of the same strength, and should then be dressed with gauze or wool and carefully protected from the air. Applications with an oleaginous or petroleum base are preferable to dry dressings; and the following ointments generally prove satisfactory: (1) Ol. "Sanitas" 1, Soft Paraffin 40. (2) Thymol, gr. 5; Soft Paraffin, ℥j; dissolve by heat. (3) Ung. Eucalypti (B.P.) [U.S.P. Ol. Eucalypt., 1 part; Paraffin., 4 parts; Petrolat. Alb., 5 parts]. (4) Ung. Acidi Carbolici (B.P.), ℥j; Ung. Paraffin. Alb., ℥j.

Escharotics should be used with great caution. Their employment is justifiable only when the sores have become callous or are spreading rapidly, and even in such circumstances more satisfactory results may generally be obtained by careful scraping and the application of mild antiseptic and emollient ointments. As the discharges from yaws sores usually give an acid reaction, alkaline lotions have been suggested as appropriate dressings; and the application of a 2 per cent. solution of bicarbonate of soda or of carbonate of ammonia is undoubtedly of great service in relieving pain and in allaying the intolerable itching which attends the formation of scar tissue. Alkalies, however, appear to be less effective than dilute antiseptics in inducing healthy action. Mercurial lotions and ointments are apt to cause severe inflammatory reaction in yaws sores and are unsuitable for general use. They may, however, prove beneficial when there is a combined infection of syphilis and yaws, a condition which is less infrequent than is generally supposed to be the case.

Constitutional Treatment.—It is questionable whether internal remedies have any influence in modifying the severity or the type of infection during the earlier periods of systemic invasion; but in the later stages of yaws iodide of potassium almost invariably induces marked improvement in the general condition and appears to exercise a definite specific effect on the progress of the disease. Yaws patients show remarkable tolerance for the drug, and adults can generally take 15 grains three times a day for long periods without discomfort. In smaller quantities the remedy is ineffective, and unless iodides can be given in full doses and for a considerable time it is useless to prescribe them. Atoxyl (3 grs. hypodermically every alternate day) has also given good results, and Castellani has shown that, combined with a course of iodide of potassium, subcutaneous injections of atoxyl may prove efficacious in severe and chronic cases which have resisted all other methods of treatment. When yaws is uncomplicated by syphilis mercury almost invariably does harm. It has no remedial value, and dangerous anæmia is a frequent result of its administration. Children who are suffering from malnutrition and emaciation as a consequence of constitutional infection are specially liable to mercurial intoxication. Iron and arsenic may generally be given with marked advantage at all stages of the disease.

In the treatment of systemic yaws the importance of diet can scarcely be over-rated. The food should be unusually abundant and nutritious and should contain a large proportion of fat. Milk, butter, eggs, fresh meat, fish and green vegetables are specially indicated. Salted, pickled and preserved foods are injurious, and alcohol in all forms should be avoided.

Remarkable success in the treatment of yaws has recently been obtained by the intramuscular and intravenous injection of dioxy-diamido-arseno-benzol (Ehrlich's 606). Strong, of Manila, who used[1] the remedy in twenty-five cases, found that in every instance a single injection was sufficient to produce a cure, even although the disease had reached an advanced stage. He regards the drug as an ideal specific for yaws, and states that the results are not only immediate, but that there is every reason to believe that they are permanent. Castellani, in Ceylon, found[2] that of six recent cases five were apparently cured by a single injection. Three months later one patient had a slight relapse, which yielded readily to a second injection. In two severe cases of ten and fifteen years' duration, distinct benefit followed the injections, but the patients were not completely cured. Similarly successful results have been obtained by other observers, most of whom state that when the dose is sufficient, marked improvement takes place at once and relapse is of very rare occurrence. The usual method of administration is to rub up 0·30 to 0·40 gramme (5 to 6½ grains) of the powder with a little methyl alcohol, and then to dissolve it in 20 to 30 c.c. of sterilised water. The solution thus prepared is deeply injected at two points into the gluteal muscles, 15 to 20 c.c. in each place. Intravenous injection appears to be quite safe, and as it causes no pain or local reaction is generally preferable. All instruments must of course be carefully sterilised.

W. CARNEGIE BROWN.

References.

[1] Strong, R., "Archiv. f. Schiffs. u. Tropen. Hygiene," 1911, XV., pp. 89—94.

[2] Castellani, A., "Archiv. fur Schiffs. und Tropeu. Hygiene," Leipz., 1911, XV., p. 11.

LOCAL DISEASES OF OBSCURE ORIGIN.

AINHUM.

As regards the treatment of ainhum there is little to say. The fold of skin under the last joint of the little toe is very liable to injury and wounding, by glass or sharp grasses, in those who go bare-footed, and such lesions should always be attended to and treated with antiseptics. When left open and unattended Wellman believes that jiggers persistently invade them and so keep up a constant irritation. In that case these parasites must be removed, and if the patient wears shoes the latter should be well soaked in a strong tobacco-juice infusion, as this is very toxic to the jigger.

When a definite constricting band appears it should be divided freely. At later stages conservative treatment is of no avail, and the most commonly adopted procedure is to amputate the toe. There is no evidence that the condition has anything to do with leprosy or scleroderma.

G. C. LOW.

BIG HEEL.

The etiology of big heel or endemic hypertrophy of the os calcis is quite unknown, and very little has been done in the way of treatment in the few cases recorded. Maxwell[1] tried potassium iodide without effect. In one instance he trephined the affected bones and this seemed to give relief. Counter-irritation with iodine might be tried, especially when the disease becomes chronic.

G. C. LOW.

Reference.

[1] Journ. Trop. Med., 1905, VIII., p. 82.

CHAPPA.

By some, Sir Patrick Manson for example, chappa is supposed only to be a tertiary phase of yaws. Dr. R. W. Gray, of Southern Nigeria, recently sent me a thread-like structure which he had removed from the base of an ulcer, the description of which closely corresponded to Read's chappa ulcers; this I found to be a *Filaria volvulus*. It is therefore possible that this parasite may have been the cause of some of the ulcers noted by Read, and might even account for the apparent sense of fluctuation in the joints described by him.[1] The treatment of the condition is still *sub judice*. The fact that Read found that mercury and potassium iodide had no curative effect on the ulcers indicates that the condition is not a syphilitic one. Thorough scraping of the diseased part, with a subsequent application of pure carbolic acid, may do good, though when healing is taking place at one part the disease may break out in another. If the *Filaria volvulus* should eventually prove to play a part in this disease, scraping would be the treatment to recommend. If the joints swell they should not be opened. Hot fomentations may be tried, and it is just possible that mercurial ointment might do good.

G. C. LOW.

Reference.

[1] Read, E. H., Journ. Trop. Med., 1901, IV., p. 333.

CLIMATIC BUBO.

In the treatment of this condition the patient should be confined to bed so as to give the part affected complete rest. At the same time a smart purgative should be given, and after this a light diet, chiefly milk, should be prescribed. At the stage before definite suppuration has occurred carbolic fomentations (1 in 40), applied warm, are of distinct value in reducing the inflammation, and in some instances they are even successful in preventing suppuration taking place. Cantlie[1] recommends the application of pressure on the gland itself, this being accomplished by placing a conical pad of lint and cotton-wool in alternate layers over the affected part, and then exerting pressure on these by a tightly applied figure-of-eight bandage. This procedure may be supplemented by the application of unguentum hydrargyri ammoniati or linimentum potassii iodidi cum sapone to the surface of the skin before applying the pad. Scheube[2] quotes Priessnitz as saying that the fever and swelling in this condition quickly abate when the gland is treated with graduated compresses, and quinine, iron and arsenic are given internally. After the acute stage has passed, even though suppuration has not taken place, a chronic swelling tends to remain, and in these cases I have found that resolution may be considerably hastened by painting the part with strong linimentum iodi, repeating this if necessary in three or four days. Concurrent diseases such as malaria should be suitably treated, and tonics and a sufficient quantity of good food should be administered during the period of convalescence.

If suppuration takes place the condition must be treated surgically. Cantlie advises an incision of ample length parallel to the groin; the necrosed gland or glands should then be removed and the part scraped with a sharp spoon. All sinuses must also be scraped and drained by counter-openings, and the wound packed with iodoform gauze. Early excision of a climatic bubo is to be avoided; no operative treatment should be adopted until evidence of the presence of pus is undoubted. The after-treatment of the condition is to be carried out on ordinary surgical lines, and the cavity washed out frequently with antiseptic lotions and packed afresh with clean gauze. If healing is very prolonged it is possible that some necrosed tissue still remains; this must be removed. The patient's strength must be kept up during the convalescence, and if a change of climate is possible, this should be strongly advocated.

G. C. LOW.

References.

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[1] Cantlie, article on "Climatic Bubo," Allbutt and Rolleston, "System of Medicine," 1907, Vol. II., Part II., p. 723.

[2] Scheube, "The Diseases of Warm Countries," translated from the German, 2nd ed., Lond., 1903, p. 227.

CRAW-CRAW.

Many different skin lesions have been and are described under this term. The name has been applied indiscriminately to scabies, acne, papules and pustules of any kind and to many other indeterminable lesions. Leaving all these out of account, however, there is still an apparently specific skin lesion of a papulo-pustular nature, which Emily has described under this name. It appears to be limited to certain parts of tropical Africa, and I have seen it, or at least a closely allied disease, in Uganda. The treatment for scabies, acne, etc., will be described under these headings. For definite craw-craw Emily recommends the following: Pustules are to be opened, and ulcers, if they exist, should be scraped, and the parts then thoroughly washed with corrosive sublimate lotion (1 in 1,000). Boracic powder is then dusted on the part, and boricated vaseline applied on lint, and the whole covered with absorbent wool and a bandage. After a week the parts are said to be perfectly healed. In Uganda I found that washing the parts with carbolic-acid solution (1 in 40) seemed to have a curative effect on the papular stage. In other cases mercurial ointment (blue ointment) was efficient. For the itching of the papular stage an ointment, consisting of cocaine and menthol (āā 10 per cent.) lanoline ℥j, was found not only to be soothing, but also to some degree to be curative. The bowels should also be kept freely open during the cure.

G. C. LOW.

GOUNDOU.

If Maclaud's suggestion,[1] that goundou is started first of all by the larvæ of some insect that finds its way into the nose, should prove to be correct, then the early treatment should aim at the expulsion and destruction of these parasites. Quite recently Shircore[2] has reported a case of this disease from Nyasaland, the history of which strongly corroborates Maclaud's original view. Inhalations of chloroform and injections of creolin or turpentine should be actively used if there is any suspicion of myiasis, and any ulceration or abrasion of the mucous membrane of the nose should be attended to antiseptically. In the later stages of the disease, when soft cancellous bone has formed with its covering of compact bone, the only treatment is removal of the mass with the chisel or bone forceps. Discharge from the nose and ulcerations of the mucous membrane generally disappear at this stage, but they should always be looked for and treated if present. If the tumours are small and not causing any special inconvenience, then they are best left alone. Potassium iodide has been tried, but neither it nor any other drug has ever produced any appreciable diminution in the size of the growths.

G. C. LOW.

REFERENCES.

[1] Arch. de Méd. Nav., January, 1895, abstract British Medical Journal, 1895, I., p. 1217.

[2] British Medical Journal, 1910, I., p. 503.

ONYALAI.

Wellman[1] and Massey[2] both describe cases of an acute infectious disease occurring amongst the natives of Angola, West Africa, and called by the latter onyalai.

The disease appears to be a specific entity, one of its features being the formation of hæmorrhagic bullæ, occurring on the surface of the body or on the tongue, soft palate or buccal mucous membrane. The disease is specially feared by the natives, and deaths from it are common. Massey treated his cases with bicarbonate of soda and cod-liver oil, and most of them recovered. Wellman tried quinine, various alkaline salts, oil of turpentine, acetate of lead, tannic acid, ergot and supra-renal extract with no perceptible results. Arsenic, however, in full doses, seemed to benefit some of the patients. The natives employ various plants, notably *Geigera Wellmani*, Hutch, and a species of Albizzia, *A. anthelmintica*, A. Brong.

G. C. LOW.

REFERENCES.

[1] Wellman, F. C., Journ. Trop. Med., 1904, VII., p. 55; Proceedings of the American Society of Tropical Medicine, 1908, Article 14.

[2] Massey, A. Y., Journ. Trop. Med., 1904, VII., p. 269; 1907, X., p. 116.

TROPICAL SKIN DISEASES.

Tropical skin diseases may be considered under the following headings: (1) Non-Specific Diseases, (*a*) Prickly Heat; (2) Diseases caused by Bacteria, (*a*) Tropical Phagedena or Tropical Ulcer, (*b*) Pemphigus Contagiosus, (*c*) Veldt Sore; (3) Diseases caused by Vegetable Parasites, (*a*) Erythrasma, (*b*) Piedra, (*c*) Pinta or Caraate, (*d*) Ringworm in the Tropics (including Tinea Cruris and Tinea Imbricata); (4) Diseases caused by Animal Parasites, (*a*) Jigger or Sand Flea (Dermatophiliasis), (*b*) Larva Migrans, (*c*) Myiasis, (*d*) Mycetoma or Madura Foot, (*e*) Water Itch or Coolie Itch.

PRICKLY HEAT.

Prickly heat is an acute inflammatory affection connected with perspiration, characterised by the presence of numerous small acuminate red papules or vesicles on a red base, and associated with distressing pricking or itching. It is due to excessive heat, and is extremely common in tropical countries, attacking almost every European soon after going into residence abroad. It prevails chiefly in the hot season, when an attack may be brought about by a variety of causes, such as unsuitable underclothing of flannel or rough woollen material, violent exercise, sudden alterations in temperature from cold to heat or *vice versâ*, hot foods, alcoholic beverages and, most frequent of all, hot drinks or soups.

The prognosis should be guarded, as the affection may prove most intractable. In time the tendency to it may die out; but in many individuals, in spite of every care being taken to avoid it, attacks are almost certain to occur when the hot season comes on. These attacks may be transitory, lasting only a few days, or they may be so frequent that they overlap one another and render the disease practically continuous as long as the hot season lasts. In individuals who have suffered from prickly heat a predisposition to it is apt to be established, by which they are liable to attacks when they return to temperate climates as the result of some comparatively slight cause.

General Management.—The different exciting causes which are well known to determine an attack should be scrupulously avoided, such as hot drinks, long drinks, alcohol, excessive smoking, violent exercise and unsuitable clothing. The underclothing should be made of silk and cotton, and woollen or flannel garments discarded, as they are not only unpleasantly hot but irritate the skin by their roughness. The bedclothes should be as light as possible and may be raised off the patient by a wickerwork cradle, which can be ventilated by large paper shafts on each side of the bed. In very hot weather a punka is a great addition to the comfort of the patient. Where possible resort should be made to a cooler climate, and a sojourn to the Hills or a sea voyage may be of the greatest value in stopping the attacks. The diet should be light, and all articles which are liable to produce irritation of the skin, such as black coffee, curries, chutney, etc., should be eschewed. Cooling drinks, provided they are not too long, such as still lemonade or barley-water with lemon in it, are grateful to the patient.

There is no internal specific for this condition, but saline aperients and diuretics are of value in reducing the tension of the blood in the skin and in making the kidneys active. Of these, acetate of potash is useful as a diuretic, as in the following formula: Pot. Acetatis, gr. 10; Spirit. Æth. Nit., ♏20; Spirit. Juniper., ♏5; Dec. Scoparii, ad ℥ss.

Local Treatment.—This should consist chiefly of cooling lotions and dusting powders, ointments and greasy applications as a general rule doing more harm than good. Of the lotions the following will be found to be of value: Carbolic Acid (1 in 40). Liquor. Carbonis Detergens, āā ℥ij; Liquor. Pb. Subacetatis, ℥j (*Sig.* teaspoonful to pint of water for use): Spirit. Vini, ℥ij; Extr. Hamamelis Liq., ʒij; Aq. Rosæ, ℥iv. Calamin. Prep., ʒiss; Zinci Oxidi, ʒiss; Glycerin., ʒj; Aq. Laurocerasi, ad ℥iv.

These should be applied where possible by soaking a piece of cotton in them, laying it on the itchy part and keeping it moist. After this dressing is removed, one or other of the following dusting powders may be employed: Salicylic Acid, gr. 10; Zinc Oxide, ℥ss; Starch, ℥ss. Camphor, gr. 10; Zinc Oxide, ℥ss; Creta Prep., ℥ss.

In extensive cases relief may be obtained from alkaline baths containing 2 oz. each of bicarbonate of soda and borax to 10 gallons of water at 90° Fahr., bran baths, or oatmeal baths.

J. M. H. MACLEOD.

TROPICAL PHAGEDENA OR TROPICAL ULCER.

THIS form of ulceration, which is endemic in tropical and subtropical countries and characterised by the presence of a chronic sloughing sore with a grey false membrane, a fœtid exudation, and a tendency to infiltrate and destroy underlying tissues, is, as a rule, an intractable condition. Its clinical characters and course all point to the conclusion that it is the result of the inoculation of a specific microbe in a susceptible individual, but the exact micro-organism which is responsible for it is at present unknown, and its method of transmission is not understood. It is known to be auto-inoculable, but the evidence in favour of its being directly contagious is incomplete. It seems more than probable that the virus, whatever it may be, is transmitted by some infection carrier, such as an insect or some blood-sucking vermin. Of the predisposing causes, one of the most important is a weak state of general health such as may be brought about by exhaustion, want of food, or some wasting disease like scurvy, dysentery or malaria. The prognosis of the affection under suitable treatment in the majority of cases may be regarded as being favourable, and the affection may be eradicated in the course of a few weeks or months. The resulting scar, however, is often unsatisfactory, almost invariably disfiguring, and is liable to break down again on the slightest injury. It rarely tends to spontaneous recovery, and if left alone in individuals in a depressed state of general health is liable to assume fulminating characteristics, destroying underlying structures and even causing a fatal issue through pyæmia or septicæmia.

Prophylaxis.—As tropical phagedena is capable of incapacitating large numbers of native labourers and soldiers campaigning in a country where it is endemic, every effort should be made to prevent its recurrence. For this purpose it is of the first importance to attempt to protect the legs and feet of the native. It is difficult to induce him to wear boots, however, even if they could be provided, but adequate protection may be obtained from sandals or puttees of some light material. When cases occur they should be isolated as far as possible, and to avoid overcrowding in the hospitals the patients may be treated in temporary huts or under canvas.

General Treatment.—This consists in placing the patient under as satisfactory hygienic conditions as possible, providing him with plenty of good food and fresh vegetables and dealing with any obvious defects in health on general medical principles. In cases of malaria quinine should be prescribed, and in syphilis iodide of potassium and mercury. Opium in full doses has been strongly advocated (Manson) for the double purpose of reducing the phagedena and relieving the pain. In the case of Europeans a change of climate to a district where the condition is not endemic, or a sea voyage, may be followed by healing of the lesion under proper treatment. In cases where the sore is extensive it is imperative that the patient should lie up and that the affected limb should be properly bandaged and kept elevated.

Local Treatment.—This to be successful must be energetic and thorough. It is necessary, in the first instance, to remove the false membrane and the sloughing tissue. This may be done by a thermo-cautery, by which means an occlusive scab is produced which separates in about a week and leaves a clean granulating surface. It is better, however, to scrape it away with a sharp spoon, and if the lesion is extensive to do so under a general anæsthetic. After thoroughly curetting the floor of the ulcer it should be swabbed with pure carbolic acid, or irrigated with 1 in 1,000 sublimate solution or 1 in 2,000 potassium permanganate, and dusted with an astringent antiseptic powder, such as equal parts of iodoform and boric acid. An antiseptic dressing, such as 15 gr. of ammoniated mercury in 1 oz. of soft paraffin, or protargol (5 to 20 per cent.) in vaseline (Castellani), spread upon lint, should be applied to the sore under a bandage. Instead of the dressing, the ulcers may be irrigated continuously with a warm antiseptic lotion. In mild cases Tschudnowsky has recommended the application of the following solution: Iodol, gr. 4; Glycerine, ♏5; Gum Arabic, gr. 10; Alcohol, ℥j. This forms an occlusive dressing by solidifying on exposure to the air. When the healing is slow Le Dantec has suggested cutting down the raised edges of the sore and applying strips of diachylon plaster to draw the edges together and exert continuous pressure on the granulations.

In severe and extensive cases *Thiersch grafting* may have to be resorted to or the edges dissected up and brought together by sutures over the wound, and where excessive gangrenous changes have supervened free amputation of the diseased tissue may be necessary.

J. M. H. MACLEOD.

PEMPHIGUS CONTAGIOSUS.

Pemphigus contagiosus is a common cutaneous disease in the tropics, especially in hot seasons. It is an irritable vesicular condition which is extremely contagious and usually affects the axillæ and genito-crural regions, whence it may spread on to the trunk and limbs. It is a form of bullous impetigo, and most probably of streptococcus origin. The treatment is similar to that of impetigo contagiosa, and consists in the removal of crusts and the thorough disinfection of the affected parts by the application of compresses of hydrogen peroxide (10 vols.) or solutions of corrosive sublimate (1 in 2,000). The vesicles should be pricked and an ointment continuously applied, such as the following: Hydrarg. Ammoniat., gr. 14; Paraffin. Moll. ad ℥j.

After the eruption has subsided a dusting powder consisting of salicylic acid (10 gr.) with zinc oxide (℥j) should be freely dusted over the affected parts, which should be bathed regularly with boric lotion or weak Condy's fluid for at least a week to prevent relapses.

J. M. H. MACLEOD.

VELDT SORE.

The typical veldt sore is a superficial ulcer edged by a fringe of exfoliating dermatitis surrounded by an inflammatory halo, and peculiarly resistant to treatment. It came into prominence during the South African war, when it was the source of much discomfort and a large amount of invaliding among British troops, and is identical with the local sore of Queensland named Barkoo rot. The course of the affection is slow, lasting several months, and it is singularly intractable. It is due to a specific bacterium of the streptococcus type, and Harman has isolated from it a diplococcus to which he gave the name of Micrococcus vesicans. This probably gains entrance through some abrasion of the skin caused by injury or insect bites. An important predisposing factor to the infection is a low state of health brought about by hardship, fatigue, want of food, or some depressing illness. The successful treatment of the condition depends on the thoroughness with which it is carried out. The general condition of the patient should be improved by suitable measures, dietetic, hygienic and medicinal. With regard to local treatment, it is necessary, in the first instance, to clip or scrape away all the exfoliating epidermis at the margin of the sore, then thoroughly to irrigate the surface with 1 in 1,000 corrosive solution, or apply compresses of hydrogen peroxide (10 vols.). Calomel or boro-iodoform powders should then be dusted on, and an antiseptic dressing of dilute ammoniated mercury ointment applied under pieces of adhesive strapping. The local treatment should be repeated thoroughly each day until the sore has healed.

J. M. H. MACLEOD.

VERRUGA PERUVIANA (*see* p. 459).

ERYTHRASMA.

Erythrasma is an affection which is familiar to dermatologists in this country, and occurs with considerable frequency in the tropics. It is due to the presence of an exceedingly small hyphomyces and generally affects the genito-crural and axillary regions, producing yellowish brown slightly scaly patches in fair skins and a brownish scaliness in dark-skinned people. Its treatment is the same as that for mild cases of tinea cruris.

PIEDRA.

Piedra or trichosporosis is a peculiar affection of the hair which is characterised by the presence of a number of dark hard nodules, about the size of nits, on the hair shaft. It is most common in South America in the valleys of Cauca, in Columbia, and usually affects the hair of the head in native women, but it has also been observed on the eyelashes, and on the hair and beard in men. The affection is due to aggregations of a fungus which is said to grow readily in the mucilaginous fluid, resembling linseed oil, with which the native women dress their hair. Allied, if not identical, conditions have been observed in other parts of the tropics and in temperate zones under the headings of "Trichomycosis nodosa tropica" in Ceylon and India, "Piedra nostras" in Germany, and "Tinea nodosa" in this country.

The disease does not tend to disappear spontaneously, and is somewhat intractable. The treatment is similar to that employed for the softening and removal of nits, and consists in saturating the hairs with some solvent such as turpentine, or equal parts of crude paraffin and olive oil, for an hour or more under a bathing cap, and then thoroughly washing the scalp with soap and water. This process should be repeated as often as necessary until the nodes have disappeared. Sponging the hair with hot corrosive sublimate lotion (1 in 1,000) has also been recommended. In resistant cases it may be quicker in the end to clip the hair short or shave it, and to apply a mild parasiticide ointment, such as sulphur precipitate 10 gr., salicylic acid 10 gr., and soft paraffin 1 oz.

J. M. H. MACLEOD.

PINTA OR CARAATE.

The name Pinta or Caraate has been applied to a group of epiphytic diseases of the skin, characterised by the presence of variously coloured patches probably due to different hyphomycetic fungi, and occurring chiefly in tropical America. Up to the present time this group of diseases has not been thoroughly worked out. It is an exceedingly chronic and intractable condition associated with much pruritus, especially when the patient becomes warm in bed, and with considerable disfigurement.

The treatment of it is similar to that of ringworm of the glabrous skin. When it occurs extensively the patient should be immersed in a warm bath and scrubbed with soft soap and an anti-parasitic ointment applied, such as the following: Resorcin, ʒj; Glycerine of Starch, ʒij; Soft Paraffin, ad ℥j: or Sulphur Precipitate, ʒss; Salicylic Acid, gr. 10; Soft Paraffin, ad ℥j.

Instead of the ointments nascent sulphur lotion may be used. This is formed by applying a solution of hyposulphite of soda (6 per cent.) on lint covered with oiled silk for ten minutes, and subsequently painting the areas with a 3 per cent. solution of tartaric acid. When large areas of the cutaneous surface are involved it is inadvisable to apply these remedies over the whole of the affected parts at once, but they should be treated *seriatim*.

When the eruption is confined to a few localised patches stronger applications, such as tr. iodi, pyrogallol and chrysarobin, may be used. Chrysarobin should be rubbed on in the form of an ointment containing 20 to 30 gr. to the ounce of ungt. zinci oxidi, or dissolved in traumaticin (guttapercha ʒj, chloroform ℥j) and painted on the lesions.

When patches occur on the face they should be treated by the application of dilute ammoniated mercury ointment or the following: Resorcin, gr. 15; Salicylic Acid, gr. 10; Soft Paraffin, ad ℥j.

For some time after the affection has been apparently cured the previously affected areas should be rubbed daily with a 2 per cent. sulphur and salicylic acid ointment, and a dusting powder containing Salicylic Acid, gr. 10; Zinc Oxide, ℥ss; and Starch, ℥ss, should be dusted on the skin and on the inside of clean underclothing.

J. M. H. MACLEOD.

RINGWORM IN THE TROPICS.

Ringworm in one form or another has an almost universal distribution. The treatment of tropical ringworm in general is similar to that in temperate zones, but there are two forms of it, the treatment of which requires special consideration here, namely, tinea cruris or dhobie's itch and tinea imbricata.

Dhobie's Itch.—Dhobie's itch is a term which has been somewhat loosely applied in the tropics to a number of pruriginous skin affections in the belief that they were communicated indirectly through wearing clothing which had been washed by the dhobie or native washerman and so contaminated, a belief which is not substantiated by actual fact. The principal conditions which have been included under this heading are tinea cruris or ringworm about the crutch, erythrasma, eczema, and the bullous form of impetigo, to which Manson gave the name of "Pemphigus contagiosus." Among medical men practising in the tropics it is becoming more and more customary to restrict the use of the term to the first of those conditions, namely, tinea cruris.

Tinea Cruris.—Tinea cruris or dhobie's itch is a most intractable form of ringworm due to several varieties of large-spored ringworm fungi, which attacks moist intertriginous regions, such as the crutch, axillæ and beneath the breasts in stout women. It is prevalent all over the world, and is especially distressing in warm climates such as India, Burmah and China. Its occurrence in regions of the body which are naturally warm and moist enables the fungus to grow rapidly, and to produce considerable irritation and inflammation. Owing to scratching and the secondary inoculation of pus cocci, eczematisation and impetigo may be superimposed, and so painful may the affected areas become as to render it necessary for the patient to lie up. The condition is always worse in hot weather or when the patient becomes warm in bed. It may disappear completely in the cold season or if the patient goes to the Hills, and the skin may assume a quiescent, brownish, scaly appearance like erythrasma, but a recrudescence soon takes place when the hot weather returns. It shows no tendency to heal spontaneously, and if left alone is liable to persist indefinitely.

As it is a purely local affection and does not in the least interfere with the general health of the patient only local treatment is necessary, but to be successful this must be thorough.

In mild cases the affected regions should be scrubbed with soap and water, or with soap-spirit lotion and a strong parasiticide ointment rubbed in twice daily or applied continuously under a T-shaped bandage, such, for example, as the following: Sulphur or Resorcin, ʒss; Salicylic Acid, gr. 20; Soft Paraffin, ad ℥j. Oxidised Pyrogallol, gr. 15; Glycerine of Starch, ʒj; Soft Paraffin, ad ℥j.

After the application of the ointment a dusting powder consisting of equal parts of sulphur, boric acid and zinc oxide, or one of salicylic acid 15 gr., and zinc oxide ℥j, should be applied to absorb moisture and reduce the irritation.

Instead of ointments lotions may be resorted to with an equally satisfactory effect, such, for example, as the nascent sulphur lotion which is formed by the application of a 6 per cent. solution of hyposulphite of soda on lint covered with oiled silk for about ten minutes, followed by painting the part with a 3 per cent. solution of tartaric acid. Another useful lotion is Velminck's solution of sulphurated calcium. To prepare this 1 oz. of quicklime, 2 oz. of precipitated sulphur, and 15 oz. of water, are boiled together in an earthenware vessel, reduced to 10 oz., and the clear sherry-coloured fluid decanted after subsidence. This should be painted on every night for a week, when a cure will usually be effected.

In obstinate cases where these remedies prove ineffectual chrysarobin should be resorted to and applied in the form of a 2 to 6 per cent. ointment, rubbed in twice daily till the affected patch reacts and becomes inflamed, when the applications should be stopped, as the reaction generally indicates that a cure has taken place. When chrysarobin or Goa powder is used it is necessary to warn the patient of its disadvantages in staining clothes and irritating sensitive parts like the conjunctivæ, and it is unsafe to place it in the hands of the ordinary native. Applications of turpentine have also been recommended, the turpentine being rubbed on in the morning and an ointment applied at night, but this remedy must also be used with caution, as it is apt to produce a dermatitis.

In a certain number of cases where eczematisation and weeping or fissured lesions have been produced chrysarobin is too irritating a remedy to be employed, as it would be certain to aggravate the disease. In such cases the condition should in the first instance be soothed by the application of milder remedies, such as the following: Resorcin, ʒss; Salicylic Acid, gr. 15; Zinc Oxide, ʒij; Soft Paraffin, ad ℥j: or Resorcin, ʒss; Glycerine of Starch, ʒj; Soft Paraffin, ad ℥j.

Not infrequently painful fissures occur about the inguinal regions; these may be obliterated and the itching associated with them removed by painting with a 3 per cent. solution of nitrate of silver in spirit.

When by this means the inflammatory disturbance has been sufficiently reduced the more powerful treatment with chrysarobin, turpentine, etc., may be resorted to. As in all parasitic cutaneous diseases, it is necessary that the clothing which had been worn previous to the cure of the disease should be destroyed or thoroughly disinfected.

After the affection appears to have been cured, in order to prevent a recrudescence the parts should be painted with a 10 per cent. solution of iodine in 60 per cent. spirit every day, and the patient should be recommended to wear short cotton bathing drawers and to powder the inside of them with equal parts of boric acid, zinc oxide and sulphur.

Tinea Imbricata.—The treatment of this peculiar form of ringworm, which is so prevalent among the natives of the Malay peninsula and to which the graphic name of "Tinea imbricata" has been applied by Sir Patrick Manson, is difficult and disappointing. The disease has no tendency to disappear spontaneously, and in most cases, though it is easy to obtain a temporary improvement and an apparent cure, the eruption usually reasserts itself as soon as the treatment is discontinued. The main difficulty connected with it is the extent of the eruption and the practical impossibility of dealing with it sufficiently thoroughly. When possible the patient should be immersed in a warm bath and the scales removed by soft soap or sand soap. This procedure should be repeated as often as necessary. Strong solution of iodine [U.S.P. ℞. Iodi, 12·00; Potassii Iodidi, 7·20; Aquæ Destillatæ, 12·00; Alcohol, 86·40] or a solution of resorcin (ʒij) in a tincture of benzoin (℥j) (Castellani) are the most effective local applications. The latter is applied once or twice daily to the affected region, and if the whole cutaneous surface is involved different halves of it may be treated on alternate days. This procedure must be continued for several weeks, and even though it is applied over large areas symptoms of absorption from it are rare. The solution of iodine may be used in the same way, but it is less effective than the resorcin-benzoin solution. The extent of the eruption, as a rule, renders it somewhat unsafe to use stronger applications, such as chrysarobin or pyrogallol. These remedies, however, are useful when the disease i localised to a few patches, and should be employed in the form o ointments containing 2 to 5 per cent. in ungt. zinci oxidi.

J. M. H. MACLEOD.

JIGGER OR SAND FLEA (DERMATOPHILIASIS).

THE sand-flea or jigger is a parasite which gives rise to a distressing cutaneous disturbance, to which the name "dermatophiliasis" has been applied. This flea has now a wide distribution and is steadily making its way round the world from tropical America and the West Indies, to which it was originally confined. It chiefly attacks the soles of the feet, the interdigital clefts, and the skin about the roots of the nails, and burrows into the epidermis, forming small nodules, in the centre of which the posterior segment of the female flea may be seen protruding as a black dot. As a rule, no serious consequences result from the presence of the parasite, but occasionally from secondary inoculation phagedenic sores, erysipelas, or even tetanus may be caused by it. When the eggs mature they are extruded and fall into the dust on the floor of the habitations or the sand around them, where they hatch into larvæ and go through their developmental cycle.

The prophylactic measures for the avoidance of this parasite are as follows: The feet should be carefully examined daily, especially under the nails, for jiggers. They should be anointed with clove oil, and where possible they should be protected by thin stockings and high boots. Great care should be taken to keep the habitations clean, and they should be swept of dust, and the floor sprinkled with Jeyes' fluid, naphthol, or some other disinfectant. Native children with bare feet, which are liable to be infected, should be prohibited from entering the habitations, and poultry, pigs, etc., should be kept at a distance from them.

The actual treatment of the condition consists in the removal of the female flea as intact as possible by means of a clean blunt knife, an operation which the natives become very skilful in doing. Should any part of it remain it should be touched with pure carbolic acid. Occasionally it may be difficult to get at the jigger, and it may even be necessary to remove the nail to do so. The ulceration which is left should be treated with antiseptic lotions, boro-iodoform powder, or dressed with a mild mercurial ointment.

J. M. H. MACLEOD.

LARVA MIGRANS.

Larva migrans is a generic name which has been applied to the larvæ of certain flies, such as Gastrophilus and Hypodermia bovis, which burrow in the skin in a linear fashion and produce a peculiar linear affection which is known as "creeping eruption." This is characterised on the skin by the presence of a narrow red line, which is straight or sinuous and scarcely raised above the surface. It extends several inches every day, the redness being most marked at the advancing end. The larva is situated about $\frac{1}{2}$ inch beyond the end, and its position may sometimes be determined by pressing the blood out from the skin by a piece of glass, when it appears as a brownish speck.

The treatment of the affection is unsatisfactory unless the larva is removed or destroyed. This may be done by excision of the small piece of skin beyond the anterior end of the line which contains it. If the exact position of the larva is determined by the diascope an incision should be made over it, and it should be removed by forceps and the cavity irrigated with carbolic lotion. It may also be destroyed by a thermo-cautery, imitating the fashion of the native women in Arabia, who destroy it with a red-hot wire. Other simpler but less effective methods consist in hypodermic injections of cocaine, chloroform or carbolic acid, in the situation of the larva.

J. M. H. MACLEOD.

MYIASIS.

Myiasis is a comprehensive name applied to lesions caused by the presence in the skin and subcutaneous tissues of the larvæ of certain flies. Though cases of this affection are most common in tropical countries, they are by no means confined to them, but are also met with in colder latitudes, such as Norway. This subject is still imperfectly worked out, and in a considerable number of cases the precise fly which is responsible for the condition remains to be identified. Of the larvæ which cause myiasis the best-known are the screw-worm, the *ver du Cayor*, and the *ver macaque*.

The screw-worm, which is the larval stage of a bottle-fly (Lucilia macellaria), which occurs chiefly in South America, attacks man and domestic animals, and deposits its eggs on the skin, in wounds, or on the mucous membrane of the nose or auditory canal of natives sleeping in the open-air. On being hatched the larvæ cause comparatively little harm on the skin beyond setting up a painful abscess; but should they penetrate deeply they are capable of producing destructive changes with the formation of foul crateriform ulcers or fungating masses like epitheliomata, and not infrequently may cause fatal results from septicæmia or meningitis from the penetration of the larvæ into the brain.

The *ver du Cayor* is the larva of the tumbu fly (Cordylobia anthropophaga), which prevails in Senegambia. The larva causes a painful swelling or abscess in the skin, situated not infrequently about the buttocks and thighs. In the centre of the boil an opening may be present in which the posterior end of the larvæ may be observed.

The *ver macaque* is the larva of a gad-fly (Dermatobia cyaniventris), which is found chiefly in Central America. When present in the skin they cause an abscess which is deep red in colour, may reach the size of a pigeon's egg, and has been termed a "gad-fly boil."

The treatment, to be successful, must be prompt and thorough. For the screw-worm affection the diseased cavity should be swabbed out with pure benzine, or irrigated with 1 in 20 carbolic lotion or chloroform water. If the larvæ have reached the frontal sinus inhalations of chloroform have been recommended to kill them, and the cavity should then be opened up and freely irrigated to expel the parasites.

The boils caused by the larvæ should be treated on ordina surgical principles, freely opened, the contents expressed a thoroughly irrigated. Should the larva be noted in the cen opening of a boil it should be seized by the forceps and forci extracted. In South America a simple method of dealing wi them is adopted, namely, allowing tobacco juice to trickle into t opening of the boil, which causes the larva to protrude, and so be easily expressed. Another method, employed by the Brazilia is to try to asphyxiate the larva by tobacco smoke, or by closi up the opening with fat. In this way the larva may be compell to protrude itself in order to breathe, when it can be easi extracted.

J. M. H. MACLEOD

MYCETOMA OR MADURA FOOT.

Mycetoma is a disease which usually affects the foot, and is characterised by swelling and deformity, with the degeneration of the affected tissues and the formation of cysts with fistulous openings containing an oily putrid fluid in which mycotic aggregations are suspended. It is chiefly endemic in India, but is not confined to that peninsula, having been found in Africa, Asia, America and even in Europe. There are a number of varieties of this disease, which are due to different species of fungi belonging to the genera aspergillus and discomyces. It is essentially a disease of agricultural districts, attacking chiefly barefooted natives in the fields and plantations. It is believed that the fungi have their habitat in the soil or dust, and gain entrance through wounds and abrasions of the skin caused by sharp stones, bites or stings of insects, or pricks from spines of plants or splinters of wood.

The course of the affection is slow, and it does not interfere to any extent with the general health of the sufferer till it is well advanced. It is a purely local condition, and very rarely shows any tendency to invade the internal organs, but it is usually associated with serious consequences if left untreated, for gradually, from secondary causes, such as septic absorption, anæmia, poverty and starvation, from loss of work owing to the interference with walking caused by the disease, the sufferer, after a course of ten or fifteen years, generally succumbs from exhaustion, inanition, or some intercurrent disease.

The disease shows no tendency to spontaneous healing, and once it has become established nothing short of surgical removal stops its progress. There is no specific medicinal treatment for it, and iodide of potassium, which is of undoubted value in the treatment of actinomycosis, a somewhat allied condition, has no beneficial effect on it. In early cases it may possibly be arrested by cauterisation, curetting, or excision of the initial lesion ; but when it is well advanced partial or complete amputation is necessary, the incision being made in the healthy tissue well beyond the lesion. As the disease is a purely local condition, the prognosis, after thorough surgical interference, is excellent. As preventive measures, the feet should be protected where possible by boots or sandals, and should a wound or abrasion be present every precaution should be taken to keep it aseptic and properly dressed until it has healed.

J. M. H. MACLEOD.

WATER ITCH, OR COOLIE ITCH.

Water itch is a form of vesicular dermatitis which attacks the feet of coolies working in the tea gardens in Assam in the wet season. It occurs also in the West Indies, British Honduras, and in the southern United States, and has probably a wider distribution. It is believed to be due to the penetration of the skin by the embryos of ankylostoma, while the ulceration and phagedena which are occasionally associated with it are regarded as the results of secondary pyogenic inoculation. Though the disease in itself, unless complicated by gangrene, is a comparatively trivial affection, it is still of great economic importance to the planter, since, after heavy rains, it may incapacitate as many as 5 per cent. of the coolies.

The treatment consists in opening the vesicles and dusting on boro-iodoform powder. If open sores are present, compresses of hydrogen peroxide (10 vols.), followed by dressings with a mild mercurial ointment, should be employed. In addition, the feet should be bathed daily in a 1 in 40 carbolic bath ; the coolie should then be confined to the hospital until the lesions have healed.

As a preventive green Barbados tar has proved of value in the West Indies. Every morning the feet and legs of the coolies are painted over with the tar, and they are then made to walk through fine sand or sawdust, which adheres to the tar and forms an impermeable covering. In some tea-gardens the coolies are made to wear "kurrams," or *sabots*, with high heels at each end, which raise the feet from the ground and prevent them from being contaminated with the infected mud.

J. M. H. MACLEOD.

CERTAIN DISEASES CAUSED BY PARASITES.

ANKYLOSTOMIASIS (UNCINARIASIS, HOOKWORM DISEASE).

Prophylaxis.—The prevention of ankylostomiasis, a term which must be regarded as including infection by both varieties of hookworm, has been greatly simplified by recently acquired knowledge as to the principal facts in the life history of these nematodes. Since it has been definitely ascertained that the ankylostomes of man are never naturally parasitic in the lower animals and that the larvæ arrive at sexual maturity only inside the human alimentary canal, it follows that all infection originates from the latter source and that the cardinal principle of prophylaxis must be the devitalisation of ova-containing dejectâ. If that precaution were carried out nothing else would be necessary. The conditions of the embryonic development of the worms are, indeed, such that the ultimate eradication of the disease would naturally result from the general adoption of almost any method of sewage disposal which accords with modern ideas of cleanliness.

The measures necessary for the **prevention of ankylostomiasis** naturally arrange themselves in two divisions. They comprise: (1) Precautions against the introduction of the disease into healthy communities; (2) measures designed to prevent the infection of healthy persons in places where ankylostomiasis is endemic.

Although it has been shown that both ova and larvæ are able to survive exposure to very low temperatures, certain conditions appear to be necessary for their free development and subsequent access to their host. Chief amongst these are moderate atmospheric heat, a copious supply of air, moisture and frequent pollution of the unprotected skin by mud or earth in which there are living larvæ; and as in these circumstances there is not and probably cannot be any general contamination of the soil in the higher latitudes, the danger of the introduction of ankylostomiasis into towns and agricultural districts in northern Europe is extremely remote. In cold countries, however, certain industries have to be carried on in conditions which afford favourable opportunities for the development of the larvæ; and in the case of deep mines, many of which are already infected, the danger is one of considerable importance. Recent investigation has, however, shown that although ankylostomiasis is prevalent in the coal-mines of the Continent, it is confined to metalliferous mines in Great Britain, and that Cornwall and Lanarkshire are as yet the only districts which are affected.

In most European countries and in many of our own tin-mines stringent regulations for the repression of ankylostomiasis have been successfully enforced. The pail system of latrine is made compulsory, and pollution of the soil by defæcation is severely punished. The workmen are kept under continual medical supervision; men in whose dejecta ova are found are isolated and treated; and all applicants for employment, especially those who come from infected mines, are subjected to repeated examination. If they are found to harbour parasites they are detained for treatment and observation until thoroughly cured.

In the great majority of cases in which they have been adopted, these methods have secured complete immunity from ankylostomiasis for uninfected mines and communities; and in view of the disastrous outbreaks of the disease at St. Gothard, the absolute exemption from infection of the men who were employed on the construction of the Simplon tunnel is a striking instance of what may be effected by systematic examination and the exclusion of worm-carriers.

Greater difficulty has, however, been experienced in exterminating ankylostome larvæ in already infected mines. The problem is, to a large extent, an economical one, and whatever means are adopted, (1) they must besides being effective be inexpensive; (2) they must not injure the products or plant of the mine or the boots or clothes of the workmen; (3) they must not pollute adjacent streams or water sources; (4) they must not be injurious to the health of the workmen, nor must they increase the risk of accident. Sir Thomas Oliver has shown that these conditions may be satisfied by covering infected soil with a layer of cinders from the engine-room, and that when placed round latrine pails and in the drainage channels of the main ways, furnace refuse is quickly fatal to all forms of nematoid life. In mines near the coast, sea water, which has a similar effect, should be used for sprinkling and flushing; and where there is no danger of fire the lower ends of pit props should be dipped in creosote, a substance which rapidly destroys the young worms. A 1 per cent. solution of ferrous sulphate also acts as a powerful poison to ankylostome larvæ; and as a ton of the salt, which can be bought for £8, is sufficient to kill all the embryos in a length of 60 miles of roadway a yard wide, it should prove a cheap and reliable disinfectant. In the Westphalian mines milk of lime has been used with success.

The routes of entry are the skin and the alimentary canal, and as the larvæ are active climbers and readily penetrate worn or loosely woven fabrics, it is essential that the feet and legs of workmen in infected mines should be adequately protected. On no account should miners be allowed to work barefooted; their boots should be sound and waterproof, and additional protection should be secured for the feet and ankles by smearing the boots with suet containing 1 per cent. of creosote. Facilities should also be given for frequent washing with some inexpensive disinfectant soap, and for the removal of mud and dirt from the skin by an abundant supply of water. The cleansing of the hands before eating is of special importance, and all food and water consumed in a mine should be carefully preserved from contamination by soil. The use of sanitary pails and the destruction of the dejecta should, of course, be compulsory.

Even when these measures are systematically carried out, although the ratio of infection may be greatly decreased, it is generally impracticable to exterminate all the ova and larvæ in a mine, and as they may live for many years no relaxation of precautions is possible. At a colliery in Westphalia the number of infected men was found to be one in five at the first round of examination, one in eight at the second, one in twelve at the third, and one in thirty at the fourth, but continued isolation and treatment of worm-carriers and repeated disinfection of the mine failed to make any further reduction in the case incidence. It has, however, been satisfactorily established that although an irreducible minimum of infection persists for years, the extension of the disease can be limited, and that it can be ultimately eradicated by effective supervision and treatment.

In the tropics the prophylaxis of ankylostomiasis presents greater obstacles. There the conditions necessary to the maturation of the ova are exceptionally favourable; infection is general, and the difficulty of impressing a native population with the necessity of elementary sanitary precautions is almost insuperable. Infected dejecta are everywhere deposited in fields, in gardens, in plantations; larvæ develop rapidly and in phenomenal abundance; wells and water supplies are widely and generally infected, and labourers almost invariably work barefooted. In the tropics, indeed, ankylostomiasis is practically co-extensive with agricultural enterprise. Still, even in centres of intense infection, much may be done for the limitation of the disease; and recent experiences at

Porto Rico and other places and plantations where prophylaxis has been carried out on a large scale have shown that systematic precautions are invariably followed by a surprising measure of success.

In these *foyers* of ankylostomiasis the infection is so universal that the examination of new arrivals is of less importance than where the community is healthy; but as a rapid increase in the number of worm-carriers often follows the importation of a batch of labourers from an infected district, it should nevertheless be undertaken. Reliance must be placed chiefly on the compulsory use of proper latrines; and as inexpensive incinerating appliances are now manufactured at many places in the tropics, their installation, even on small estates, is a sound investment.

Besides the provision of sanitary pails and the combustion of all night-soil, further precautions are advisable. A clear space should be left between land under cultivation and coolie lines, which should be regarded as infected soil and treated by repeated applications of lime. If incinerating latrines are unavailable, trenches used by the workmen should be disinfected in the same way, and on being changed should be deeply filled in with earth.

The feet and legs of native labourers working on contaminated land may be made impervious to the attacks of larvæ by smearing the skin with tar, but it is an unsatisfactory method of protection, and it is difficult to persuade coolies to adopt it. A muster of the whole of the labour force on tropical plantations should be held once a week for medical inspection, and workmen who have any symptoms of anæmia should be placed under observation and treatment.

Treatment.—The expulsion of the adult parasites from the intestine may be satisfactorily effected by various forms of remedial treatment. Ordinary anthelmintics are, however, of no use, and special methods, generally known as the thymol, the eucalyptus and the beta-naphthol treatments, are usually employed.

The Thymol Treatment.—After a careful examination has shown that the heart and other important viscera are sound, the patient is placed on a low diet consisting chiefly of soft boiled rice or other light farinaceous nourishment, and the bowels are freely opened by saline aperients. On the morning of the third day, and before any food is taken, a cachet containing 15 gr. of powdered thymol is given at 7 a.m. and repeated two hours afterwards. This is, however, a small dose; and when the physique and general strength of the patient appear to warrant it, two cachets, each containing 20, 25 or even 30 gr., may be safely given. Many authorities recommend still larger doses and more frequent repetition, but personal experience indicates that it is inadvisable to order more than two cachets on the same day. The treatment should be continued for two or three days, and repeated, if necessary, at intervals of a week. After the second dose a little soup may be taken, and if there is no movement of the bowels within the next four hours a saline aperient (mag. sulph., ʒss) should be given.

In my own practice I have never seen any ill-effect follow the administration of thymol, but several instances of poisoning, with symptoms of severe cerebral and renal irritation and failure of the heart's action, have been reported, and precautions to obviate the danger of free systemic absorption of the drug are imperative. In the first place, as it is readily soluble in oils, alcohol, ether, chloroform and glycerine, none of those substances should be given during the administration of thymol. It is especially important that no wine or spirits should be allowed and that castor oil should not be prescribed as a purgative. It must also be borne in mind that the action of thymol is strongly depressant and that when there is any form of heart or kidney disease or severe anæmia, it is advisable to adopt one of the other methods of treatment. Small doses are, however, ineffective; and unless a quantity which may be expected to expel all parasites can be tolerated, treatment by thymol is worse than useless.

The Eucalyptus Treatment.—A combination of eucalyptus and chloroform has of late years been widely used in the treatment of ankylostome infections, and has proved itself to be a reliable anthelmintic which is specially adapted for administration to children and to weak and debilitated patients. The remedy is generally prescribed as a draught, the usual formula being: ℞. Olei Eucalypti, ♏30; Chloroform. Pur., ♏45; Ol. Ricini, ʒx; Misce. The patient having been prepared for treatment in the same way as for thymol, the draught is given in two portions in the early morning, half an hour being allowed as an interval between the doses. It should be repeated on three consecutive days.

The effect of the remedy is chiefly due to the absorption of the chloroform, which reaches the capillary blood-vessels of the mucosa in sufficient strength to paralyse the adult worms and thus cause them to relax their hold. As they burrow deeply into the intestinal wall and absorb considerable quantities of blood serum, a narcotic in the circulation affects them rapidly and severely. The dose of chloroform is a large one, six to eight times the maximum quantity approved by pharmaceutical authorities; but a smaller dose would probably be useless, and so far no untoward result appears to have followed this liberal use of the drug.

The Beta-naphthol Treatment.—In beta-naphthol we possess another remedy which, if less powerful and effective than thymol, has many other marked advantages. It is a safe, inexpensive, tasteless and reliable anthelmintic; and is, therefore, specially suitable for general administration when it is necessary to treat an infected community in circumstances where close supervision of individual cases is impossible.

The doses usually recommended (3 to 10 gr.) are insufficient; to secure an anthelmintic effect in an adult at least 45 gr. of beta-naphthol are necessary, and this quantity should be given in three cachets of 15 gr. each in the early morning at intervals of two hours. For a child five years old two cachets of 5 gr. each are a safe and generally adequate dose. Careful preparation of the patient is essential to the success of the beta-naphthol treatment. On the preceding day he should be confined to a liquid diet, and for twelve hours before the administration of the remedy no food at all should be allowed. Preliminary purgation by a saline is also advisable. The treatment should be repeated once a week for a month, or even longer. The Porto Rico Commission found that beta-naphthol might be given without danger at all ages and at all stages of infection; and the remarkable results which followed their efforts to rid the island of ankylostomiasis attest its uniform safety and efficacy as an anthelmintic.

Other drugs, such as filix mas and ficus dolearia, are occasionally prescribed, and are frequently successful in effecting the expulsion of ankylostomes; but their action is irregular and uncertain, and in comparison with the eucalyptus and beta-naphthol treatments they are less efficacious and their use is attended with greater danger of systemic absorption.

The **after-treatment** of ankylostomiasis should be directed to counteracting the toxæmic effects of the infection and to improving the general health. Glycero-phosphates, Easton's syrup or iron and arsenic generally prove satisfactory tonics, and a liberal and nutritious diet is imperative.

W. CARNEGIE BROWN.

ASCARIASIS, OXYURIASIS AND TRICHOCEPHALIASIS.

Prophylaxis.—Unlike most of the other nematode parasites of man, the roundworms Ascaris lumbricoides, Oxyuris vermicularis and Trichocephalus trichiurus pass the whole of their active existence in the alimentary tract, they have no secondary or larval stage of development, and they attain sexual maturity without the aid of an intermediate host. Moreover, although horses, dogs and other domestic mammals frequently harbour worms of similar appearance, it is believed that each genus of host has its own species of parasite, and that roundworm ova excreted by the lower animals do not develop in man. Infection, therefore, takes place only by direct transference of embryos while still *in ovo* from one human alimentary canal to another; and the lines which prophylaxis should take are, in consequence, clearly indicated.

As in the prophylaxis of other intestinal parasitic infections, attention to general cleanliness, to the sterilisation of drinking water, to the proper disposal of excreta and to the prevention of food infection by insect carriers, are the most important measures of precaution. The frequency with which helminthiasis occurs in children is to a large extent due to the fact that there is often great carelessness in removing dejecta, soiled napkins, etc., from nurseries and living rooms, and that ova are conveyed by flies from these sources of infection to milk and other articles of diet. The part played by flies in the dissemination of helminthiasis is, indeed, scarcely appreciated; for experiment has shown that it is sufficient for a fly to rest only for an instant on contaminated dejecta to become an ova-carrier, and it is probable that infection is spread in this way more often than by any other route.

ASCARIASIS.

The frequency of ascariasis in rural districts as compared with cities is explained by the fact that privies afford greater facilities than a system of water sewage for this method of pollution. Limitation of the number of flies by clearing away their breeding places in house refuse and dust-heaps, is therefore only second in importance to the disinfection or destruction of dejecta.

Treatment.—Santonin, the classical remedy for intestinal roundworms, may always be relied on to expel ascarides, and is often effective against other varieties of nematodes. The dose for an adult is 5 gr., and for a child from three to four years old 2 gr. daily, given on alternate days and repeated three times. On the days when no santonin is taken a purgative should be given. For children the best aperients for use in combination with santonin are pulv. scammonii co. and calomel; and for adults calomel, followed by a saline purge. There is considerable variation in susceptibility to the physiological action of santonin; and accurate dosage is of great importance, as small quantities are useless, and full doses have been known to cause convulsions and delirium.

The following are suitable formulæ for the treatment of ascariasis at various ages:

(1) *Santonin.*—For an adult	℞. Santonin, gr. 5	With equal quantities of Sacch. Lactis.
From 12 to 18 years old .	,, ,, 4	
,, 10 ,, 12 ,, .	,, ,, 3½	
,, 6 ,, 10 ,, .	,, ,, 3	
,, 4 ,, 6 ,, .	,, ,, 2½	
,, 2 ,, 4 ,, .	,, ,, 2	
,, 1 ,, 2 ,, .	,, ,, 1	

(2) *Purgative.*—For a child 5 to 10 years old, 2 to 2½ to 3 gr. Pulv. Scammoniæ Co. [U.S.P., Resin. Scammonii, 4 parts; Jalapæ, 3 parts; Zingiberis, 1 part], with ½ to 1 gr. of Calomel. For a child 2 to 5 years, 1 to 1½ to 2 grs. Pulv. Scammoniæ Co., with ¼ to ½ gr. of Calomel. For adults: ℞. Hydrarg. Subchlor., gr. 4 vel 5; Sacch. Lactis, gr. 3 [U.S.P., ℞. Hydrarg. Chlor. Mit., gr. 4 vel 5; Sacch. Lactis, gr. 3]; ℞. Sal. Karlsbad-Sprudel Pulv., ʒij; Aquæ, ʒviij.

The anthelmintic properties of santonin are specially marked when it is given in the form of emulsion with castor oil. The following draught is suitable for a child 8 to 12 years old: Santonin, gr. 3 to 3½; Saccharin, gr. ½; Castor Oil, ʒiij. Mix, and emulsify with ½ oz. of Mucilage of Acacia. Then add Aq. Menth. Pip., ʒss to ʒij.

Unless one can make certain of the source of supply it is inadvisable to order santonin in the form of chocolate and sugar tablets. Many of the commercial preparations sold as worm sweets are compounded with insufficient care, and if a package is examined it is not unusual to find that one bon-bon contains a large quantity of santonin, and that the drug is almost entirely absent from several of the others. The official santonin lozenges (1 gr. each), if manufactured by a reputable firm in accordance with the directions given in the Pharmacopœia, are, however, generally reliable; and personal experience of cocoids, a proprietary preparation consisting of chocolate, santonin and calomel, is favourable. It should be noted that the official lozenges of the United States Pharmacopœia, which are frequently sold in Great Britain, contain only ½ gr. of santonin as compared to 1 gr. of the British official lozenges.

OXYURIASIS.

Besides general hygienic measures to prevent the spread of threadworm infections in families and institutions, special precautions are necessary to check auto-infection. Oxyuris ova are frequently found under the finger nails of infected children and are no doubt often carried in this way and by soiled hands directly to the mouth or to articles of food. When there is any suspicion of threadworms, sleeping drawers of strong cotton, made without openings, should be substituted for nightdresses; the hands should be frequently cleansed and the finger nails kept short. Infected children ought always to occupy separate beds.

If these general and special hygienic precautions are followed oxyuris infection tends to spontaneous cure, and the parasites generally disappear without further active treatment than the occasional administration of a brisk saline purge. For children eight to ten years old, 2 drachms of Epsom salts with ½ drachm of cream of tartar in a tumblerful of water every third morning, is a suitable aperient. In oxyuris infections santonin is not so reliable an anthelmintic as it is in ascariasis, but in combination with scammony it frequently effects a cure in obstinate cases. Naphthalene is also a safe and useful remedy. For a child five years old, 2½ gr. suspended in an emulsion of 3 drachms of castor oil and an equal quantity of mucilage of acacia, with a drachm of syrup of lemon [U.S.P., syrup of citric acid], is an ordinary dose, and this draught should be repeated every morning for three days.

If these remedies fail to expel the worms local medication must be employed. A favourable method of treatment in the Eastern tropics is the occasional administration of an enema made by boiling two small roots of garlic in a quart of water for an hour; and personal experience tends to confirm the popular belief that this decoction is an effective cure for threadworms. Sea water is also an excellent local anthelmintic; 12 to 14 oz. are sufficient for a child eight to ten years old, but for adolescents 2 pints or more are required. Infusion of quassia, weak dilutions of tincture of iron (♏40 to Oj) [U.S.P., ♏30 to Oj] or of creosote (½ per cent.)

and solutions of sulphate of copper (1 in 2,000) or of thymol (1 in 2,500), may also be tried. Of these drugs creosote appears to be the most efficacious.

Whichever remedy is selected, it is important that it should reach the cæcum, the favourite habitat of the parasites, and precautions should always be taken to prevent the premature expulsion of the injection. The best attitude for the administration of anthelmintic enemata is the left prone position; with the hips well raised across a hard pillow (on which the left trochanter rests), and the face and chest turned down to the bed. During and for ten minutes after the operation the patient should lie perfectly still; movement and massage (which are often recommended) are contra-indicated, as they tend to induce spasm and uncontrollable accumulation of flatus. The tube and its connections should be carefully freed from air before introduction, and as large a quantity of fluid as can be borne should be injected. Local irritation about the nates, which is generally much aggravated by scratching, may be relieved by the following ointment: ℞. Orthoform, gr. 20; Zinci Oxidi, gr. 20; Pulv. Amyli, gr. 30; Paraff. Mollis, ℥j; M.

TRICHOCEPHALIASIS.

As there is always great difficulty in getting rid of the mature parasite when once established in the alimentary canal, it is fortunate that whipworm infection, which is common all over the world and unusually prevalent in the more thickly populated areas of Great Britain and Ireland, is seldom or never followed by serious symptoms. Treatment of any kind is, indeed, frequently deprecated, and many physicians hold that as the consequences of infection are so slight and the prospect of expelling the parasites so remote, the administration of strong anthelmintics is unjustifiable. On æsthetic and sanitary grounds, however, the eradication of whipworm infection from a community appears to be eminently desirable, and whenever trichocephalus eggs are found in the dejecta a persistent effort should be made to dislodge the parent worms.

Full doses of guaiacol, thymol, salol or turpentine offer better prospects of success than other drugs, and personal experience indicates that turpentine is, *par excellence*, the anthelmintic for use in trichocephaliasis. On many occasions I have seen large numbers of whipworms voided after a few doses (℥ss to ℥j) of emulsion—an emulsion prepared as follows:—30 gr. of powdered gum acacia are rubbed up at first with a fluid drachm of turpentine, and afterwards with an equal quantity of water, the mixture being gradually made up to an ounce by trituration with mistura amygdalæ [U.S.P., emulsium amygdalæ]. If the patient is unable to take turpentine, thymol may be given in cachet in the same way and with the same precautions as when the drug is prescribed for the removal of ankylostomes. Full doses of guaiacol, salol and other derivatives of salicin are frequently followed by the passage of whip worms, but santonin, eucalyptus and beta-naphthol are entirely ineffective in trichocephalus infection.

W. CARNEGIE BROWN.

BILHARZIA DISEASE.

The treatment of infections by the *Schistosomum hæmatobium* may be divided into (1) preventative and (2) curative, the former being of the greatest importance, because of our inability to kill or expel the parasite once infection has taken place.

Prophylaxis.—The complete life-history of the different species of the *Schistosomidæ* has not yet been worked out, and so far it is not certain how these parasites gain access to the human body. It may be that the miracidium or ciliated embryo directly penetrates the skin, a suggestion recently put forward by Looss; but analogy would lead one to believe that a development in the tissues of a water-snail, crustacean, or mollusc is first of all necessary, the passage to man from that situation either being direct (swallowing the intermediate host in water) or indirect, for example a stage of the parasite leaving the intermediate host and being taken up in the water, or penetrating the skin from such water. There is nothing inherently impossible in this, as the life-history of the common liver fluke, Fasciola hepatica, furnishes all such stages; but whether this is so or not, the one thing to beware of in bilharzial prevention is undoubtedly water, because this is the medium that the miracidium must have in order to preserve its life.

Looss points out that if the eggs of the worms that are ejected were rendered harmless, the patients, for example, passing them on to earth or dry sand in dry closets, the miracidia could not develop and the disease would come to an end.

When residing, then, in a country where bilharzial disease is common, great care must be taken about the water-supply. All drinking water must be boiled or filtered; salads and raw, uncooked vegetables should be strictly avoided, and if in the country, water from canals, streams, or ponds should never be drunk. It is even considered unsafe to bathe or wade in such waters also, as many believe that this is the chief way in which the infection is acquired. The source of supply for bath waters in private houses should be considered; if there is any doubt about it, the water should first be boiled, and the same applies in still greater force to the water used for baths when moving about the country districts. When infection does occur it is safer, where possible, for the patient to leave the endemic area, as otherwise re-infections may take place. If for some reason or other this should prove to be impossible, then the very strictest care must be adopted to carry out all the preventative measures mentioned above.

General Treatment.—Infections with the *Schistosomum hæmatobium* presenting symptoms must be treated more or less symptomatically, as it is not possible to destroy the adult worms, situated as they are in the many ramifications of the portal venous system. In South Africa in some districts infection is very common amongst the young adults, many of these showing practically nothing in the way of symptoms; such cases are best left alone, the patient being duly warned about the risks of re-infection. In more advanced cases with definite symptoms, such as pain on micturating, a sense of weight and heat in the perineum, blood in the urine, and pain spreading to the bladder, a certain definite line of treatment is to be laid down, this equally applying to more severe cases as well. Diet is important. This should be nutritious and plentiful, but excess of any sort must be strictly guarded against. Highly seasoned dishes, spices, relishes, and last but not least alcohol, must all be stopped. During exacerbations the patient should rest in bed for a few days, live chiefly on milk and take plenty of fluids. Violent muscular exercises, riding on horses, playing football, running, rowing and bicycling, should all be given up. Chills and cold are to be avoided as much as possible—sitting on the damp grass, going out imperfectly clothed in winter are examples—and the patient is to be specially warned about the dangers of incurring an attack of gonorrhœa or syphilis. Following up such a method of treatment as this many patients are not greatly inconvenienced. It must be remembered that the disease is a persistent one and lasts for years, and that further symptoms in the way of acute and chronic cystitis may develop or the rectum may be attacked.

Medicinal Treatment.—Drugs to act on the adult parasites have been tried, but only two of these are worth mentioning. Ruault, Harley, Sandwith and others recommend the *liquid extract of male fern*. Sandwith[1] gives it in doses of 15 minims three times a day for ten or fourteen days at a time, but not longer, as toxic symptoms, such as giddiness, headache, pain in the eyes and vomiting, then appear. He claims that the drug weakens the power of the adult worms of doing harm, diminishes hæmaturia, allays vesical irritation, and reduces the number of eggs passed in the urine and fæces. *Methylene blue* may be given in 3-gr. doses three times a day, or, according to others, once or twice a week. I have tried it without noting any beneficial results, and though the eggs in the urine in one case were deeply stained with the blue, the miracidia on the application of water came out as actively as usual.

When definite **Cystitis** supervenes, the treatment of this condition must be taken in hand. Antiseptic and anthelmintic injections for the purpose of killing the worms have been suggested by those who are evidently ignorant of the pathology of bilharzial disease. Such a procedure cannot be too strongly deprecated. The passing of sounds and other instruments in the belief that the hæmaturia is due to stone is strongly contra-indicated. If the bladder requires washing out at all, this should be done with weak solutions of hot boracic lotion. At the same time any of the usual cystitis drugs may be given internally (salol, urotropine, uva ursi, benzoic acid, helmitol, sandalwood oil, cubebs, copaiba, or buchu).

Stone and malignant disease frequently follow bilharzial disease of the bladder. Such complications must be treated surgically, as must also the question of perineal cystotomy and drainage recommended by Mackie[2] in very severe cases of the disease.

Where the **rectum** is attacked, as is very commonly the case, by the *schistosome* producing lateral-spined eggs—now supposed to be a distinct species and called by the name *Schistosomum mansoni*[3]—different treatment may be required. Sandwith (*loc. cit.*) mentions enemata of infusion of quassia in order to drive the worms away from the papillomata, and he also recommends, for the relief of the rectal tenesmus, cutting away the mucous membrane above the anus, stretching the sphincters, dabbing the wound with a solution of chloride of zinc (1 in 10), and then thoroughly washing it with saline solution. Papillomatous growths in the rectum should be removed by scraping with the finger-nail. A complete excision may be required if they are in abundance with great fibrosis of the walls of the tube. In such a case the sphincters should be left intact, if possible.

Growths due to the bilharzia in the vagina and cervix are also removed by scraping, and skin papillomata appearing upon the perineum near the anus should be cut off with scissors or a sharp knife, the edges being sutured. Fistulæ may appear in the perineum: the walls of these have generally to be scraped thoroughly before cure will take place. When the disease attacks the prostate and the vesiculæ seminales little can be done apart from preventing constipation, which greatly aggravates the condition in these parts.

G. C. LOW.

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DRACONTIASIS (INFECTION BY GUINEA-WORM, FILARIA MEDINENSIS).

Prophylaxis.—Recent investigation has shown that drinking water is the usual and probably the sole vehicle of infection, and that the young worms do not, as was formerly believed, effect an entrance into the tissues of their human hosts through the skin. Prophylaxis is, therefore, obvious and simple. Absolute immunity from infection can be secured by boiling all drinking water, and in countries where guinea-worm is endemic this precaution should never be neglected.

It should be remembered, however, that in many parts of the tropics where cases of dracontiasis are of common occurrence, there is no true endemicity and that infection is limited to certain well-defined areas which are actual *foyers* of the disorder. In British Malaya and in Ceylon, for instance, although guinea-worm is a prevalent affection, it is seen only in recent arrivals from known endemic centres, the Coromandel Coast being by far the most frequent source of origin; and although many thousands of immigrants annually come from that district, local infectivity has never become established. In all probability this is due to the fact that there are no village tanks and that infected cyclops, the secondary hosts of the parasite, are absent from the drinking water. In such places there is at present little danger of contracting the infection.

Treatment.—The tendency of the disorder is to spontaneous cure, that is to say, after the gravid female has discharged the contents of her uterus, a process which usually occupies two or three weeks, she dies and is expelled. In most cases the cavity which was occupied by the worm thereafter heals of its own accord, and little treatment beyond the application of a moist dressing is required. The discharge of the embryos may be stimulated and the period of parturition materially shortened by frequently douching the part with cold water, but further interference with the natural process of evacuation is inadvisable. Many methods of facilitating the extraction of the parasite, *e.g.*, the instillation of chloroform (Beclere), cocaine (Lefevre), &c., have been devised, but cases which are practically left to themselves do better than those in which frequent attempts are made to dislodge the worm by narcotisation and traction. The native method of keeping the extruded portion of the parasite tightly wound on a bamboo effectually prevents the exit of the uterine contents, and apart from the fact that the period of treatment is thereby indefinitely prolonged, it frequently does harm.

In many cases, indeed, serious injury results from injudicious attempts to drag a guinea-worm from its resting place in the subcutaneous structures. If it happens to be torn asunder acute irritation is caused by the escape of the embryos or by the extravasation of toxins contained in the body of the parasite; and not infrequently the inflammatory reaction is so violent that the surrounding tissue suppurates and sloughs *en masse*. The popular belief that an abscess inevitably forms round a broken worm is well founded, and no procedure should be undertaken which might cause a rupture of the subcutaneous continuity of the parasite.

Sometimes a guinea-worm can be felt lying in a coil beneath the unbroken skin, and with the aid of local anæsthesia induced by an ether spray, I have been able on several occasions to evacuate the entire parasite by a simple incision. In such cases, however, there is always the danger that part of the worm may be buried in the deeper structures, and that it may be impossible to draw the cut end out of the wound. The injection of a 1 per cent. solution of perchloride of mercury, or of a saturated solution of common salt (Roquemaure), into the mouth of the worm as soon as the head appears in the opening is recommended by some authorities, but personal experience indicates that nothing is gained by this method of treatment. The parasite is undoubtedly killed, but evacuation is generally slower than when it is left alone.

It should be remembered that guinea-worms are sometimes encountered in unanticipated situations, and that they are frequently the cause of misinterpreted symptoms. On one occasion the writer undertook an operation for the relief of suppuration in the knee-joint which was supposed to be of tuberculous origin, but on opening the synovial cavity a large guinea-worm was found coiled up behind the patella. Complete recovery followed removal of the parasite and antiseptic treatment of the joint.

W. CARNEGIE BROWN.

FILARIASIS.

The medical treatment of filariasis may be briefly summarised. No drug, so far as is known, has any effect on the adult worms lying in the lymphatics, therefore all that can be done is to alleviate symptoms when they arise. As a preventative, of course, mosquito bites are to be avoided, and such insects should be destroyed generally in areas where the disease is rife. The subject of mosquito prophylaxis as a whole is, of course, too large a question to enter into here. Most of the lesions produced by the *Filaria bancrofti* fall to the province of the surgeon, but the following may be treated medically:

Filarial Lymphangitis.—When an attack of lymphangitis comes on the patient should be confined to bed, be put on a milk diet and have a sharp purge. The limb should be elevated and may be treated with weak antiseptic fomentations. After the acute symptoms have subsided massage and bandaging the part are indicated, to try and get rid of any chronic thickening that may remain. When the lymphangitis attacks the spermatic cord, injections of morphia will be required to relieve the agonising pain.

Lymph Scrotum.—Short of surgical treatment the scrotum should be suspended in a bandage, kept clean, and powdered with a mixture of boracic acid and zinc oxide powder (*see* p. 504).

Chyluria.—If the attack is troublesome the patient should stay in bed and rest. The bowels should be moderately opened and diet should be restricted, and no fatty foods allowed. Drug treatments have been tried, but are practically useless. Gallic or benzoic acid might, however, be given a trial. Methylene blue and thymol have been used with absolutely no effect. After the chyluria disappears violent exercise should always be avoided.

Filarial Orchitis.—Treatment of this condition should be based on the lines of gonorrhœal epididymitis—rest in bed, suspension of the scrotum and strapping.

G. C. LOW.

ELEPHANTIASIS SCROTI.

Treatment.—The operation as described below.

Mortality need not be more than ·5 per cent. to 1 per cent. with due care.

CARDINAL RULES FOR SUCCESS.

(1) **Care in preparation** of case on general medical grounds for an operation of expediency.

(2) **Preparation of Site of Operation.**—Hip baths, soft soap, lin. iodi for the "ringworm" so frequently present. Massage of neck of tumour and its neighbouring healthy parts renders these latter more suitable to form the flaps.

(3) **Immediate Preparation of Site.**—All that is required is to render it surgically clean. Bear in mind that aseptic results are the aim, and these *are* obtainable in this operation just as in operations in other parts of the body. Without clean surgery the low mortality noted cannot be expected; with such precautions, other things being equal, it will result. Three applications of 7 per cent. tinct. iodine recommended, to whole site of operation, following each other at intervals of one hour. The application to be made *not* after bathing, but several hours subsequently.

THE OPERATION.

If the rubber cord is employed, apply it as in Figs. 1 and 2. Its use gives the beginner confidence, and less blood is lost in the early stages of the operation. But it is liable to slip at the most inconvenient times and soil the wound. Its removal is awkward save by an able assistant, and, if by the operator, he will defile his hands. The subsequent "weeping" is greater than when its use is dispensed with.

Incisions.—The first is made in the median line, from near the pubis to the preputial mouth. This is deepened to the dorsum of the penis, and the finger is run up and down on either side of its body, very effectually enucleating the organ from the suspensory ligament to its free extremity, where the glans is still separated from the finger by the lining membrane of the prepuce. Pull the head of the penis up and cut through this cap of "mucous membrane" in front of the glans, which is palpable with ease rough it. The organ is now free with its head covered, as it ere, with a night-cap. Slit this up, being careful to hold it away om the wound to avoid douching the old retained *smegma preputii* to the raw surface. Clean well, wrap round with a little gauze,

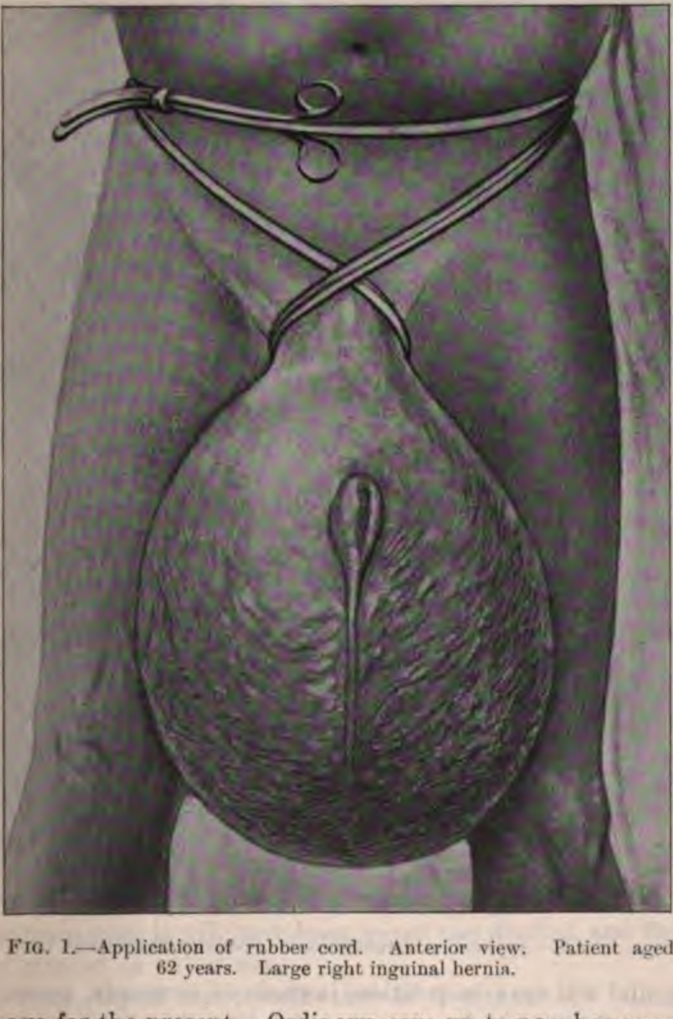

FIG. 1.—Application of rubber cord. Anterior view. Patient aged 62 years. Large right inguinal hernia.

d leave for the present. Ordinary care up to now has prevented y injury to the dorsal vein, and there has not even been a chance slitting up the penis, as some have done, in the old method of corticating, on a long-handled director, pushed in by the pretial orifice, which, by mistake, has got into the urethra instead of riving at the *corona glandis*.

Now pull the mass to the patient's right, exposing the left side of the neck of the tumour. Cut from above, near external abdominal ring, curving towards the median line in front of the anus. This incision is on the neck of the tumour, at the scrotal angle, and will vary in position, inwards or outwards, according to the state of the skin, bearing in mind that this must ever be soft and pliable, that the subcutaneous fat on exposure must have the ordinary healthy yellow appearance, with no tendency to an œdematous or blubbery look. The trunks of the vessels will be found running obliquely inwards at the upper angle, transversely inwards at the middle part, and will have an antero-posterior

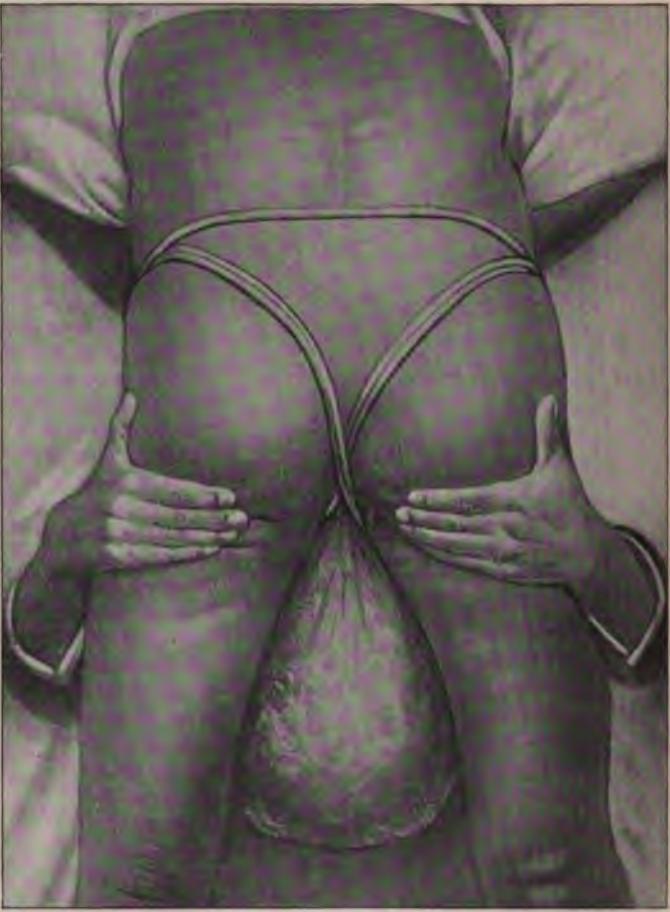

FIG. 2.—Application of rubber cord. Posterior view of Fig. 1.

direction behind. They can be seized, before section, or after cutting, with pressure-forceps. Deepen this incision gradually, and work in with finger and scalpel to near the bulb, *avoiding any hurt to it.*

Repeat the same procedure on the right side of the neck of the tumour. The two incisions will have met in front of the anus, and all the main vessels will have been seized and divided, and the bulb almost cleared on either side.

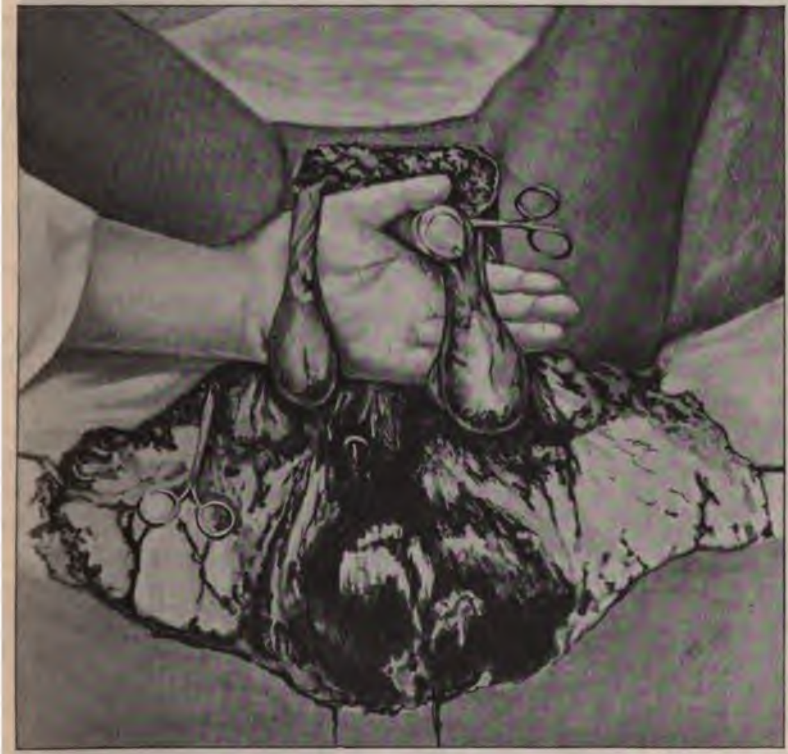

FIG. 3.—Tumour thrown down ; still attached below. Finer connections of testes require division ; all other parts of testes and cords separable by finger.

The next step is the **enucleation of the testicles**. Unite the base of the median incision with the upper end of the lateral cuts, on either side, seizing the vessels as previously described. From the centre of, say, the left of these, over the line of the cord, the knife is freely used, making a vertical wound, through the substance of the growth, which is deepened till the cord is exposed, then the finger, being inserted, is worked around the cord, and moved up and down, enucleating it and the testicle completely, save at the lowermost end of the gland, where is its firmest attachment, which is the remains of the central part of the *gubernaculum testis.* This must be cut away with blunt-pointed scissors, and every trace of blubbery material should be carefully removed at the same time from off the outer surface of the *tunica vaginalis.*

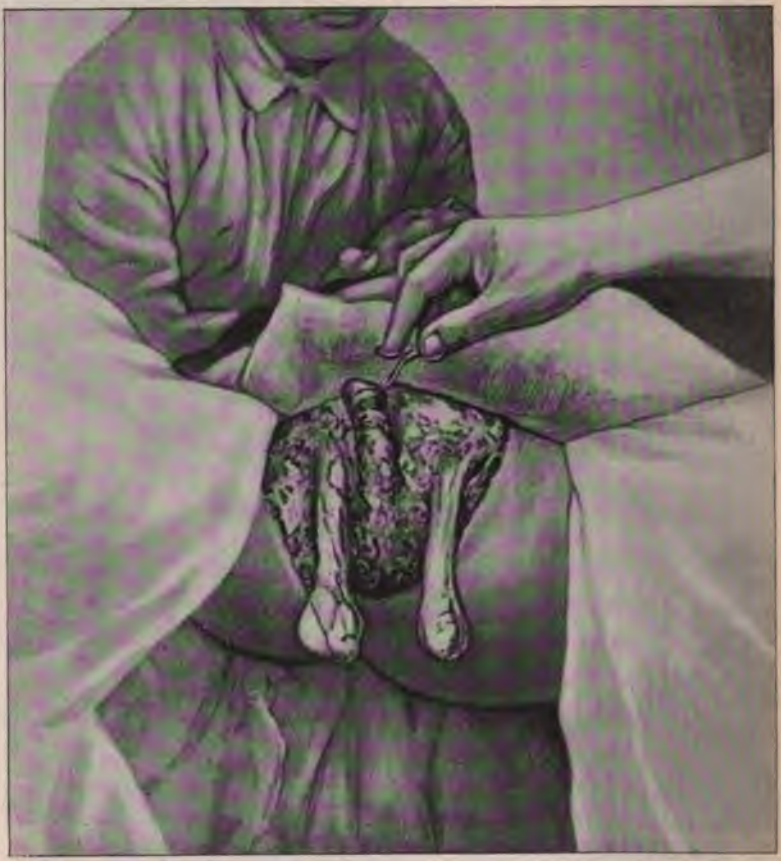

FIG. 4.—Field of operation on complete removal of tumour shown in Fig. 3.

Repeat over the right cord and testicle the process described. The firm testicular attachments are shown in Fig. 3, which illustrates the condition of the field of operation at this stage of the procedure, but before final separation of the testicles. Should a hydrocele be present it is removed unopened, it being much easier to dissect out the distended tunica vaginalis than after the escap of the fluid. Then open the hydrocele in front (be careful here, a the testicle is often distorted and transposed). Cut away the tunica vaginalis laterally on either side to near the mesorchium, being specially on your guard above and behind the *globus major* of the *epididymis*. Wrap the testicles and cords in gauze and place them on the *pubis*.

Torsion-clamp Method of Blood Stasis.—Now twist, to say four turns, each vessel held by a pressure-forceps, and before removing it, with a second forceps clamp the twisted artery. The clamp action of the second keeps up the twist, and it can be taken off in a few moments. By this method the ligature is unnecessary. Time is saved, and what may be "foreign bodies" do not interfere in the economy of the healing process.

The appearance of the field of operation on the complete removal of the tumour is shown in Fig. 4. The wound is dry, there is no "weeping," no ligatures have been used, and there is a glaze of healthy plasma.

The Flaps.—Now the skin to the right of the wound is to be drawn forwards. Its inner side is lined by the fascia of Colles, and it is the deep surface of this structure that is exposed. Pulling the skin and fascia taut, with a scalpel, make an incision through the latter ½ inch long. Put aside the knife, and entering the finger by this window, move it up and down and out, freeing the skin from its attachments to the fascia lata over the origins of the gracilis and adductor muscles.

The vessels will feel as small fibrous cords passing from the deep parts to the overhanging integument like a series of pillars from a floor to a ceiling. They are not broken by the finger, working its dissection through the superficial fascia. Although the blood-stream in them may be interrupted for a time by their somewhat rough usage, it must be quickly re-established, as I have not yet met with a single case of gangrene of the flaps.

Practice will determine the amount of covering necessary, but the free margin should come to the median line without tension. Snip with blunt-pointed scissors any portion of Colles's fascia obstructing the sliding in of the flap. Proceed on patient's left side with the same method. See that there is no oozing from where the tunica vaginalis has been cut away, nor bleeding from any portion of the cord from an injured vein. These are the only parts in the whole operation where a ligature may be found necessary. Having done so take the right testicle, place it under the skin flap on the thigh. Repeat the same with the left testicle and draw the flaps to the median line. A few temporary stitches of silkworm gut keep them in position, whilst a continuous suture run quickly up holds them firmly.

[**Operating from Behind-forwards.**—This is the more convenient and expeditious method. The cord is not used.

Throw the tumour forward on to the belly. The back and sides of its neck being thus stretched, the incisions on either side in healthy tissue and converging to the front of the anus are made, as in the method already described, the vessels being seized before section. Due care is taken of the bulb, and the dissection is carried forward till the sides of the symphysis pubis are uncovered. The mass being thrown down, all that remains to be done is to join the anterior extremities of the lateral cuts, enucleate the testes and decorticate the penis, as has been before described.]

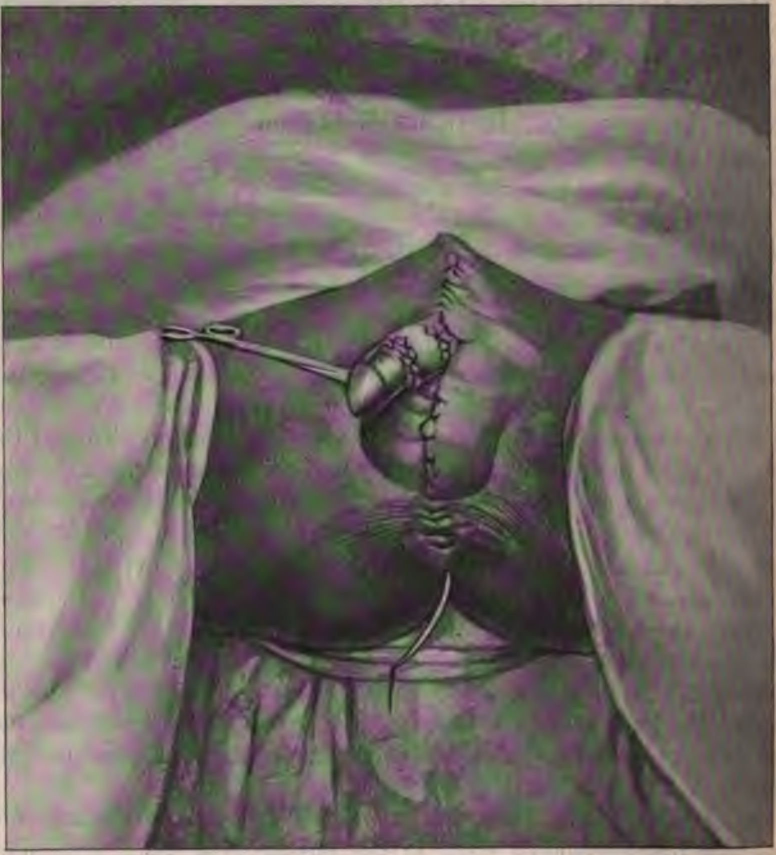

FIG. 5.—Wound (see Fig. 4) covered in by flaps from thighs. Base of penis also closed over by the same. Small reflection of healthy lining of prepuce on cervix.

Stitching the Flaps to the Body of the Penis and Grafting it.—Six sutures of horsehair, with a fine needle, should be introduced at equi-distant points through the tunica albuginea and the flaps. Avoid piercing the dorsal vessels, and merely take up the tunica and not the erectile structure.

The mobility of the skin thus treated is very considerable, so much so that it is possible in every case to bring it over the immense wounds, which at first look so hopeless (*see* Figs. 3 and 4), and provide not only a covering of sound and healthy integument to the perineum, but also to obtain immediate union as well (*see* Fig. 5). Should any small portion of the lining of the prepuce have been left, being healthy, let it be stitched to the tunica albuginea. If there is the least sign of degeneration it should be pared close to the cervix. Graft the decorticated penis with skin from the already prepared part of the patient's thigh. Steady the

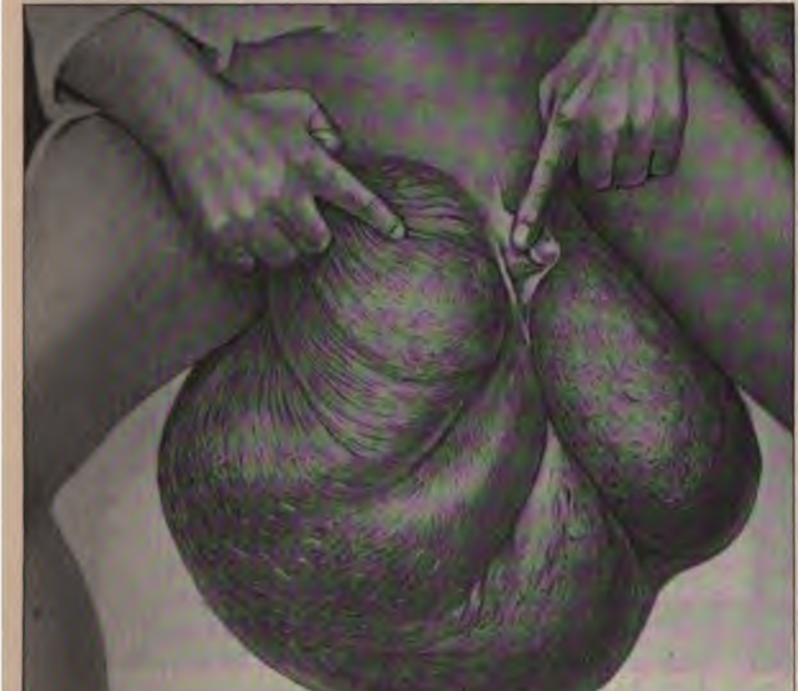

FIG. 6.—Case of recurrence in case operated on thirty years ago by old method. Shows the binding down of penis by cicatricial band. Cured by my operation.

large grafts with a stitch. Great care is to be paid to the application of the penile bandage, which should grasp firmly and evenly the corona and the tissues behind it, slacking off near the pubis.

The Chief Points about the Flaps are as follows:

(1) They are derived from the integument of the upper and inner part of the thighs over the adductor and gracilis muscles.

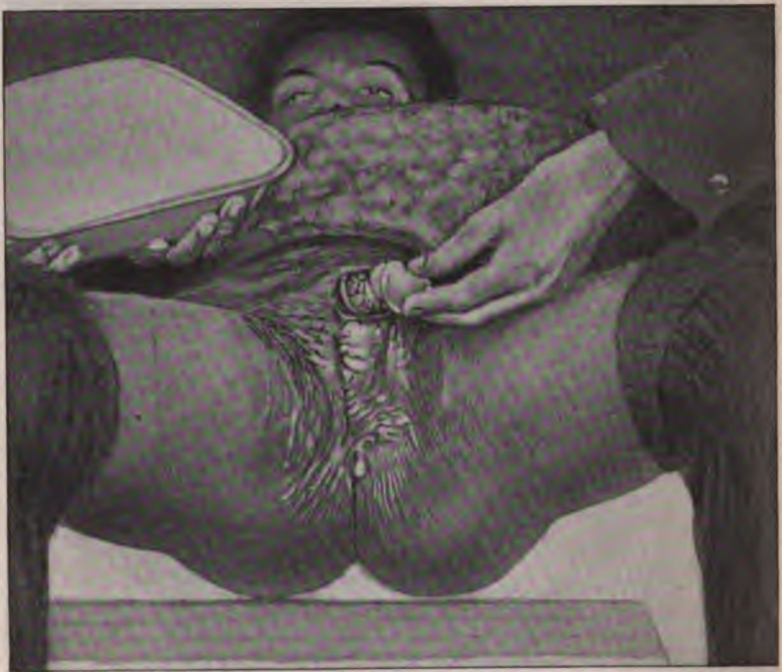

FIG. 7.—First dressing. Six days after operation. Flaps taken well. Wound aseptic.

(2) The only time the knife is used is when the little window is cut in the fascia of Colles.

(3) The finger does all the other separation necessary.

(4) The vessels are not necessarily broken.

(5) The skin is shifted by gliding.

(6) For a good result asepsis is absolutely necessary.

The Dangers connected with the Making of Flaps are:

(1) Should the wound not remain aseptic, the operator has opened up an enormous area of very absorbent tissue.

(2) If the knife is used too freely the vitality of the integument may be affected, and there will be danger of sloughing.

Figs. 5 and 7 represent the wound, shown in Fig. 4, now closed in the median line, the flaps joining on the pubis in front of the penis, and falling on its sides, where, being drawn forwards on it, they are sutured firmly to its fibrous envelope, embracing its circumference like a ferrule, and thus absolutely preventing the possibility of two granulating surfaces, common in the old operations, uniting and binding it by cicatricial tissue to the perineum, rendering it useless as to intromittent powers (*see* Fig. 6).

When Operating without the Cord:

(1) Note first the lines of approach of the vessels.

(2) Make the incisions in the order stated, seizing the arteries as soon as divided, or, on exposure.

(3) Employ no ligatures; use the torsion-clamp method.

The Sutures.—Silkworm gut for main supporting stitches on the pubis and in the perineum, and strong horsehair as a continuous suture, or not, as may be desirable. Fine needles and fine horsehair are requisite for stitching the flaps to the tunica albuginea of the penis.

Drainage is rarely required; if so, horsehair only.

The Dressing.—A strip of sterilised oiled silk may be placed over the line of the wound and another around the grafted penis. The former is not required, and may be dispensed with, as there is no granulating surface where it is applied, the union being by *first intention.* The penis, on the contrary, is grafted and injury to these must be prevented. Strips of sterilised boric lint wrung out of 1 in 20 carbolic lotion are then applied over the perineum and around the root of the penis.

Penis Dressing.—The penis being grasped by the finger-tips of the *aide*, applied to the glans, is well drawn out, and a bandage of gauze (perchloride of mercury or iodoform), 1 inch wide, is wound carefully around, fairly firmly near the cervix, less so towards the root. If this is not attended to, the end of the penis will swell, and should any healthy mucous membrane have been left from the interior of the prepuce as a flap, it will become œdematous. Again, if loosely applied, it will gape and the wound on the penis will become septic and the grafts will die.

Perineal and Pubic Dressings.—The gauze (perchloride or iodoform) in proper lengths of single filmy thickness is applied by allowing it to fall and arrange itself in folds from above down. The inner parts cling alongside of the penis, enveloping its base laterally, and also its dorsum and venter to its middle. The gauze, falling thus, adapts itself well, and should form an even and massive pad, extending back to the anus, and forwards above the pubes to near the umbilicus, and well out beyond the pubic arch on to the thighs.

When so used it gives a resilient dressing, and forms a sort of valve around the base of the penis to the bandage, on which it must be evenly and firmly stitched.

The old-fashioned way of taking many folds of dressing and cutting a hole in the centre, and then bringing the penis through the opening, is wrong, as it is then practically impossible to maintain the wound sweet. The portion of the wound most likely to get septic is that at the base of the penis; first, because it never gets rest owing to changes in the size of the penis; and secondly, if the dressings are not brought up and stitched to the sides of the penis bandage, there will be an open space on loosening of the dressings in a few hours as the patient shifts about in bed. The method recommended gives an elastic pressure with perfect and even closure of the field of operation in this dangerous region, and,

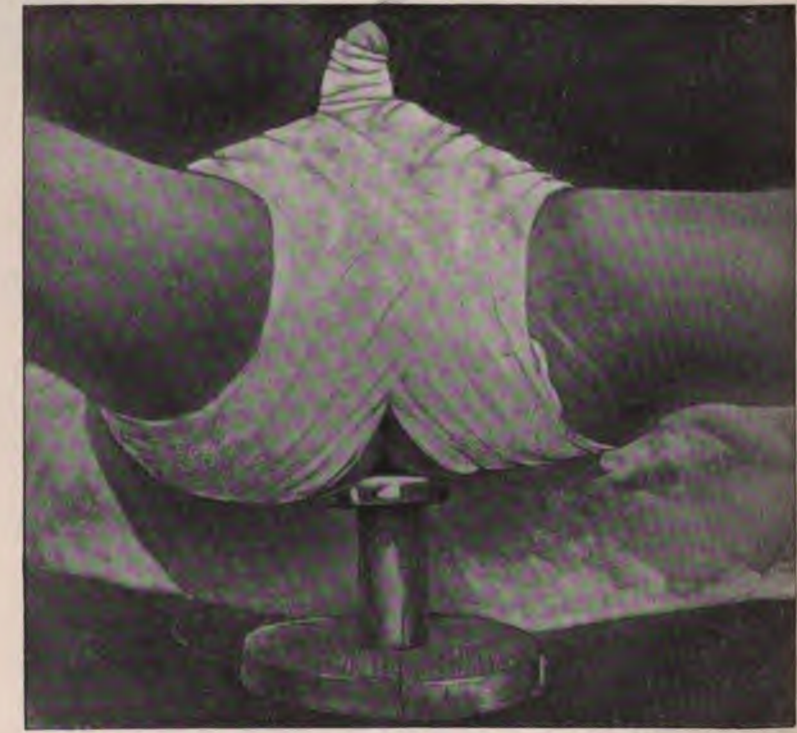

FIG. 8.—Patient on "bandaging block" which is under his sacrum. Bandage applied.

since using it first, continued experience has further impressed upon me its importance and the futility of the old way.

Bandage.—Very important indeed is the correct binding of the bandage, and it well merits its personal application by the surgeon. English bandages of calico are quite unsuitable. Fig. 8 represents the patient resting on a useful bandaging-block, and it will be found a most convenient one for the purpose. It also shows how the roller grasps the pelvis firmly and compresses the dressings on the pubes; and, in the manner of a double spica, holds the tissues firmly at the upper and inner parts of the thigh—disturbed by the shifting in of the skin for the flaps; and how it crosses and re-crosses the perineum, from before backwards and from behind forwards, supporting evenly and well the flaps covering the testes and the root of the penis. Its continuity with the penis bandage is also manifest. In fact, the pelvis and pubis, the groins, perineum and inner parts of the buttocks are so bound that the gauze is thoroughly kept in position, and yet the anus is uncovered and no obstruction is there to the passing of a soft catheter, if required. Safety-pins and a needle and thread, judiciously used, especially in the dangerous area, make everything absolutely firm, and prevent exudation and give that rest so essential for the quick healing of such an immense wound. Should the application of the bandage be slovenly or careless, the dressings shift, the margins gape, the flaps are not maintained by a uniform pressure, and sepsis is the result. If my method is pursued, other things being equal, the large wound (covered in now) will not generally but always do well, and asepsis should be the result.

Bandaging material of soft stuff is necessary for the proper carrying out of the system.

The method is recommended on account of

(1) Low rate of mortality following it.
(2) Its good, immediate and remote, results to the patient.
(3) The advantages it presents to the surgeon and hospital:
  (*a*) Patient cured quickly, wound closed and healed in eight days.
  (*b*) Owing to this more vacant beds.
  (*c*) Aseptic results, and so no fouling of air of hospital.

ELEPHANTIASIS OF VULVA.

Labia, majora and minora, and coverings of clitoris. It is not very rare. Excellent results follow removal. The operation can be done with every hope of asepsis.

ELEPHANTIASIS OF THE LEG.

Palliative Treatment:

Rest; elevation; hot air, or steam, baths with massage; Bandaging-rubber. To this may be added fibrolysin injections (2 to 4 cubic centimètres) daily (Castellani) for three to six months; interrupt for a few days occasionally. The system is to be carried out thoroughly, not in a perfunctory manner. The bandaging requires care.

Radical Treatment:

When the leg has been got into a good condition by the palliative treatment, then, if required, an attempt can be made to obtain a radical cure.

(1) Thorough surgical cleanliness of parts.

(2) Decorticate leg down to, but without injury of, the deep fascia incisions circular (in sound tissues above disease), anterior and posterior. Sole to be left intact as well as plantar surfaces of toes; incisions to be planned accordingly.

(3) Grafting to be done at once, and as large a surface covered as convenient. Arrangement for grafts to be previously made.

(4) Elevation of leg. Surgeon to give *personal* attention to dressings and subsequent care. Success depends on asepsis.

Handley recommends lymphangioplasty. Whatever method is adopted, it should be preceded by the palliative treatment.

FILARIAL HYDROCELE.

If radical treatment is called for, the open operation is that required.

FILARIAL LYMPHANGIECTASIS.

Of the Cord.—(To be diagnosed from Omental Hernia). Good results will follow from castration, with section of cord high up. Such a course should only be followed when the disease was a physical disability to the patient.

Of the Scrotum—Lymph Scrotum.—The same operation carried out thoroughly as for elephantiasis has always in my hands been followed by excellent results.

VARICOSE LYMPHATIC GLANDS.

With due care as to asepsis these may be removed. I have not experienced any of the dangers noted in text-books when carrying out this treatment. From experience in one very bad case, where surgical means had been tried and failed, radium-therapy caused the disappearance of all the glandular masses. It is worth an extensive trial.

HAVELOCK CHARLES.

TÆNIASIS (INTESTINAL).

For purposes of treatment distinction between the various species of tapeworms which are parasitic in the human alimentary tract is almost unnecessary. The methods of prophylaxis and the remedies required to effect the expulsion of the different varieties are practically the same.

Prophylaxis.—The precaution of greatest importance in the prevention of tapeworm disease is continuous care in the selection and preparation of animal food. All meat intended for human consumption should, after inspection when the animal is slaughtered, be again minutely examined before cooking, and if cysticerci are found the joint should be promptly rejected. The condition known as "measles" in pork is generally easily identified, as the cysticerci of *Tænia solium* are white and opaque and all parts of the carcase are pervaded by the parasite; but in veal and beef it is sometimes very difficult to find the minute semi-transparent bladders of *Tænia saginata*. Where there is a suspicion of infection a careful search should be made in the masticatory muscles of the animal, where, if they are present at all, cysticerci will probably be found.

Thorough cooking is also essential to the prevention of infection by meat. Raw flesh should, of course, never be eaten; and although meat properly roasted ought to show a pink tinge in the centre, if reddish serum exudes from the cut surface of a joint or a beefsteak further cooking is necessary to obviate the danger of tapeworm. Sausages are, perhaps more frequently than any other food, the vehicle of infection, and special care is necessary in their preparation for table.

The disposal of the dejecta of persons who harbour tapeworms demands particular attention. On no account should ova-containing fæces be deposited in fresh water or in fields, sewage farms and other places where cattle or pigs are allowed to feed; and, whenever possible, complete destruction by fire of all segments of tapeworm and infected dejecta should be carried out. As proglottides occasionally wriggle out of the alimentary canal, close attention to bed linen, underclothes and general cleanliness is also necessary.

Treatment.—The measures designed to expel mature tapeworms from the intestine may be divided into three stages:

(1) Preparatory, in which the alimentary canal is cleared of its normal contents, the protection afforded to the worm against the action of remedies by the residues of digestion being thus withdrawn.

(2) Medicinal, in which an anthelmintic drug, intended to kill or paralyse the parasite, is administered.

(3) Expulsive, in which the dead worm is removed by a purge.

Preparatory Treatment.—Adequate preparation of the intestinal tract for an anthelmintic is of particular importance, and more failures result from insufficient care at this stage than from any other cause. If male fern is selected, it is advisable for the patient to abstain from solid food for thirty-six hours, the nourishment during that time consisting almost exclusively of beef-tea or light soups. Small quantities of thin gruel or cornflour may also be allowed, but as milk forms a bulky and adhesive curd in the small intestine, it is unsuitable. Forty grains of pulv. jalapæ co. are given after the last solid meal, and this dose is followed next morning by half a teaspoonful of Karlsbad-Sprudel salts dissolved in 8 oz. of water. No other medicine and very little food is taken during the day; but at night half the quantity of pulv. jalapæ co. (20 gr.) is repeated, and, if the bowels are not moved freely before morning, a large soap and water enema is administered at 7 a.m. Castor oil is an unsuitable aperient, as it is less effective in dissolving the mucus by which the tapeworm is generally surrounded.

Anthelmintic and Purgative Treatment.—Unless the freshly dug rootlets of the pomegranate tree can be obtained, the *ethereal extract of male fern* (extractum filicis liquidum (B.P.)) is the most reliable anthelmintic; and of this preparation, from 45 to 90 min., according to the sex, age and strength of the patient, are administered at 8 a.m. on the morning of the third day. At 9 o'clock the dose is repeated, and the patient then remains perfectly still in bed for another hour. The remedy is best prescribed as an emulsion, the following being a convenient formula for a strong patient: ℞ Ext. Filicis Liq. (B.P.) ʒiij; Pulv. Tragacanth Co., ʒjss; Aq., ad ℥vj. [U.S.P. ℞ Oleoresinæ Aspidii, ʒiij; Tragacanthæ, Acaciæ, Amyli, āā gr. 15; Sacchari, gr. 45; Aquam, ad ℥vj.] Sig.: Half to be taken at 8 a.m.; half at 9 a.m.

The question of dosage is of great importance, and in every instance a full quantity of the drug must be given. A small dose of male fern, succeeded at a short interval by a purge, almost invariably causes the worm to break off at the neck, as it is not sufficiently paralysed to ensure detachment of the head from the mucosa. Personally, I have never seen any serious symptom follow the administration of 3 drachms. Professor Gerhardt advises 2½ to 3 drachms in one dose, for *Tænia solium*, and 3½ to 4 drachms for *Tænia saginata*. Male fern requires special selection, as many of the extracts sold by chemists are inert.

Within an hour after the anthelmintic is swallowed the whole or a large part of the tapeworm is generally passed; but, in any case, it is advisable to administer still another purge in order to clear the intestine of the drug, which if absorbed may give rise to serious symptoms. At this stage a saline is the best aperient, and a teaspoonful of Karlsbad salt will generally be found effective. Castor oil acts as a solvent of the poisonous alkaloids of male fern and should never be given after that remedy.

Careful search must now be made for the head of the parasite, for unless the whole tapeworm is passed growth will certainly recommence, and proglottides will reappear in the fæces after about thirteen weeks. If, as unfortunately happens in a considerable proportion of cases, the worm breaks off at the neck, further attempts at its expulsion should be deferred until segments are again seen. Unless there is a large surface exposed to the action of the drug the parasite is unaffected by anthelmintics, and if only the head and a short part of the body remain treatment is useless. Moreover, it must not be forgotten that the administration of tæniacide remedies requires great caution and that repetition may be dangerous.

In many parts of the tropics the *pomegranate* is to be found growing in almost every garden, and in the fresh root-bark of this tree we possess a remedy for tapeworm of unrivalled efficacy and rapidity of action. Prepared and administered as directed below it effects the removal of the entire parasite in almost every instance; and the writer has prescribed it in over forty cases of tapeworm in Europeans without a single failure. A prolonged fast is generally unnecessary, but the patient should be restricted to a light dinner of soup and milk pudding the evening before the anthelmintic is given and the intestine should be well cleared by pulv. jalapæ co. at night, followed by Karlsbad salt in the morning. At 10 a.m. (no food having been taken in the meantime) 6 oz. of a decoction of pomegranate root-bark are given, the dose being repeated at noon if the entire worm has not already been passed.

The decoction is made in the following way: 3 oz. of the finer twigs of pomegranate root are dug up, washed in cold water and bruised in a mortar. They are then boiled for ten minutes in a pint of water, and after the roots have been removed the decoction is reduced by further boiling to 12 oz. Half a minim of pure chloroform to each ounce should be added. The worm is generally expelled within half an hour of taking the remedy, and, as a rule, no aperient is necessary. Milk or soup may be given in small quantities almost immediately afterwards. Patients occasionally complain of giddiness and a peculiar sensation of intoxication, but I have never seen any serious symptom follow the administration of pomegranate root. The dried bark is certainly much less efficacious than the fresh preparation, although excellent results have been obtained from the use of a tannate of the active alkaloid, which is known as pelletierine.

Other anthelmintics which have been successfully utilised in the treatment of tapeworm are kousso, oil of turpentine and pumpkin seeds. Kousso, although formerly a favourite drug, sometimes acts as an intoxicant and produces marked nervous symptoms, and it has now almost passed into disuse. Turpentine in large doses—from ½ oz. to 2 oz., is an effective remedy for tapeworm, but in this quantity it may do serious injury to weakened or even normal kidneys. In America the seed of the common pumpkin is regarded as a reliable cure. Three or four ounces of bruised seeds are macerated overnight in a pint of boiling water and the whole of the infusion is taken at one draught in the morning after a fast of several hours. Thymol, even in large doses, appears to be ineffective against tapeworm, but naphthalene, on the other hand, is a remedy of proved value.

W. CARNEGIE BROWN.

TÆNIASIS (VISCERAL OR SOMATIC).

The neoplasms which originate in somatic infection by the larval stages of cestodes are but little amenable to medical treatment, and their development remains entirely uninfluenced by the administration of internal remedies. When they admit of treatment of any kind, surgical intervention offers practically the sole prospect of cure; and as the growths tend to increase rapidly and to assume a malignant type, success is seldom attainable except by a timely and radical operation. In the later stages active medication is necessarily confined to palliation of urgent symptoms and care of the patient's general health. On the other hand, in countries where visceral tæniasis is endemic, prophylaxis involves issues of wide importance and demands close and continuous attention. In pastoral districts where dogs are indispensable and large numbers of sheep are killed for food the suppression of hydatid disease is one of the most difficult problems of public sanitation.

Practically, only three varieties of somatic infection by cestodes in their larval stages are known to occur in man. Of these, hydatid disease, which originates in the development of Echinococcus granulosus—the larva of Tænia echinococcus—in the tissues, is the most common, and is responsible for by far the largest number of deaths; cysticercosis, infection by Cysticercus cellulosæ—the larval stage of the pork tapeworm, Tænia solium—is now infrequent, and seldom or never fatal; whilst the imperfectly understood morbid process, known as alveolar or multilocular echinococcus disease, which originates in invasion of the liver and other viscera by Echinococcus alveolaris, is rare but extremely malignant.

HYDATID DISEASE.

Prophylaxis.—The biological conditions necessary to the growth of hydatids are definitely known, and no parasitic disorder could more certainly be eradicated by the application of stringent preventive measures than this infection. Statistics have clearly proved that the prevalence of the disease both in man and animals is in direct and exact relationship to the index of canine infection by Tænia echinococcus. If no dog harboured the mature tapeworm hydatid disease would cease to exist; and, as the only way in which dogs can become infected is by swallowing flesh containing living larvæ, none could act as hosts of the parasite if all were precluded from eating raw meat.

Regulations for registration, limitation of the number, and supervision of dogs are therefore measures of the first importance to the public health. All vagrant and ownerless dogs should be destroyed. In no circumstances should registered dogs be fed on uncooked meat, nor should they be allowed admittance to slaughter-houses, butchers' shops, and other places where there may be access to scraps and the contents of offal tubs. The bladder stages of Tænia echinococcus, although commonest in mutton, are found with almost equal frequency in beef and pork, and all kinds of diseased or suspected meat should be destroyed.

Precautions to prevent the transference of echinococcus germs from the intestines of the dog to man are also essential. Infection by ova occurs in many ways. The eggs are so light that they are blown about as dust, and if they are implanted on the bronchial mucosa the shell may be dissolved by the secretions, and development may ensue at the site of actual infection. This method of transference is by no means rare. Drinking water is, however, by far the most common medium of invasion, pollution taking place either by the ova being carried into reservoirs and cisterns by the wind or by being directly washed into sources and streams from deposits of fæces or kennel refuse. Water contaminated in this way may also convey infection if it is employed to wash dishes, milk pails and other utensils, or if it is used for sprinkling lettuces, radishes and similar vegetables. Moreover, when dogs harbour mature parasites, the ripe scolices are apt to escape from the rectum, and ova are not infrequently found in the hair, ears and paws of domestic favourites. In such circumstances transference to the alimentary tract of those who fondle or tend the animals is not improbable, and numerous instances of direct infection in this way have been recorded. Many persons who keep dogs turn them out at regular intervals into the streets, and the enactment of regulations to prevent deliberate pollution of crowded thoroughfares by pet dogs is urgently necessary. Kennels, with the surrounding soil and refuse, should be frequently scalded by boiling water.

CYSTICERCOSIS.

Greater vigilance in the inspection of slaughter-houses and more intelligent and efficient methods of cooking pork have of late years effected a marked reduction in the prevalence of Tænia solium, and cases of infection by the larval stages of the parasite are now comparatively rare. The treatment, like that of other forms of somatic tæniasis, is unsatisfactory. It is hopeless to attempt to destroy the larvæ by parasiticide drugs, and no known internal remedy has any deterrent effect on their development. Occasionally cysticerci may be located in the subcutaneous tissues, in the eye, or in the brain; but their excision is seldom practicable, and, even if successful, it is only in very rare instances that surgery can ameliorate the general condition. Cysticerci may, however, be successfully removed from the iris and the anterior chamber of the eye, and as they almost invariably set up destructive inflammation, with sympathetic ophthalmia of the other eye, an operation should be undertaken as soon as their presence in the organ has been diagnosed.

ALVEOLAR ECHINOCOCCUS DISEASE.

As the source of origin and method of infection by the larvæ of Echinococcus alveolaris are unknown, scientific prophylaxis of alveolar tæniasis is impossible. The distribution of the disease indicates that dogs are not concerned in its propagation; and recent research has also controverted the belief that cattle, as was formerly supposed, act as hosts of the mature parasite.

The tumours originate in infection of the tissues by amœboid embryos, and it has been considered possible that these organisms might be destroyed by the administration of internal parasiticides. Atoxyl and other drugs, however, have proved of no avail, and although there has been insufficient time to form a conclusion, it is improbable that the morbid process can be arrested in this way. Injection of antiseptic solutions, such as formalin, has, in a few instances, appeared to be of some benefit; but in the meantime free excision of the growth, when possible, is the only known method of treatment. As the organisms infiltrate the tissues for considerable distances beyond the actual limits of the neoplasms, and as they are found in the blood-vessels and in the lymphatic spaces and glands, the tumours must be regarded as essentially malignant in character, and all secondary foci of infection must be removed along with them. In the case of large growths in the substance of the liver and other viscera it is obvious that this is practicable only in very few instances; and, except in the very earliest stages, alveolar echinococcus disease is generally inoperable.

W. CARNEGIE BROWN.

TRICHINIASIS (TRICHINOSIS, TRICHINELLIASIS).

Prophylaxis.—In Great Britain human infection by *Trichinella spiralis* is now rare, but in Germany and many other countries severe outbreaks of the disease are by no means infrequent. Trichiniasis is, indeed, easily preventable, and its disappearance in England has been chiefly due to the observation of the following precautions, which, if systematically carried out, are sufficient to obviate any serious danger of its transmission to man:

(1) Animals intended for human consumption should never be allowed to feed on trichinous flesh.

(2) Dead meat should be carefully inspected, and if larval trichinæ are found, it should be burned.

(3) Flesh of all sorts should be thoroughly cooked before being eaten.

Although the parasites are occasionally harboured by sheep and calves, in 98 per cent. of all cases of human trichiniasis infection is conveyed by the consumption of partially cooked trichinosed pork. Special care is therefore demanded in feeding pigs. They should be strictly precluded from obtaining access to raw meat of any kind, and in no circumstances should they be fed on carrion, butcher's offal or scraps. This objectionable practice is far too common, and dead rats found about farmhouses are often thoughtlessly thrown into pigstyes. It is in the interest of the breeder as well as those of the consumer that carelessness of this sort should be vigilantly suppressed, for the rat which is probably the natural host of trichinella, everywhere harbours the parasite, and a whole herd may easily become infected from a single source. The association of rats and pigs is one of peculiar danger, and styes which are infested by vermin always require careful supervision.

With the aid of a lens encysted larvæ can be readily distinguished in dead meat; they appear as minute greyish fusiform bodies, 0·4 millimètres in length, and 0·25 in diameter, and generally lie inside the muscular fibres. They are most likely to be found in the pillars of the diaphragm, in the intercostals and near the tendinous insertions of the long muscles. Meat so affected ought always to be destroyed, for although the parasites may be killed by boiling, flesh which has harboured trichinellæ cannot be otherwise than unwholesome and deleterious.

From an economic point of view, however, it is doubtful whether the considerable expenditure which the provision of a special system of meat examination entails is justifiable, even in countries where trichiniasis is prevalent. In Germany numerous legal and practical difficulties have been encountered in carrying out preventive inspections, and it is now admitted that the elaborate precautions adopted there have failed to avert repeated outbreaks of the disease. It is, besides, more than questionable whether it is expedient that the large majority of the public who cook their food should be saddled with the expense of a special department for the protection of the small minority who wish to indulge an objectionable propensity for eating raw meat. In combination with care in the preparation of animal food, the general sanitary laws which regulate and control the sale of meat intended for human consumption are at present sufficient for the suppression of trichiniasis.

The last and most efficient line of defence is to make it an invariable rule that no meat shall be eaten unless it has been thoroughly cooked. Trichinella larvæ are, however, by no means easily killed by heat, and experiment has shown that they can successfully withstand a temperature of 80° C. It is therefore apparent that even after a considerable amount of cooking a piece of pork, a chop or a sausage may still contain living organisms; and it is obvious that no meat in which marked redness remains should be brought to table. A safe rule for cooking hams or large joints is to allow half an hour's boiling for each pound of weight. As live trichinellæ are not infrequently found in lard, margarine, sausage skins, etc., these and other by-products of slaughter-houses should also be carefully sterilised by effective cooking.

Treatment.—Trichinellæ, once established in the tissues, are beyond the reach of internal remedies. No drug has the slightest effect either in destroying the organisms in the muscles or in increasing the natural power of resistance. But it is important to remember that for some time after constitutional symptoms have made their appearance mature parasites are, in all probability, still present in the intestine, and that fresh swarms of young trichinellæ are being continuously discharged into the lymph channels. If the patient is seen within twenty-four hours after trichinosed flesh has been eaten an emetic should be given at once, and for at least a month after the onset of general symptoms no effort should be spared to dislodge parent worms which may have developed in the alimentary canal. Although for this purpose ordinary anthelmintics are valueless, large numbers of parasites may generally be expelled by the continued administration of full doses of calomel. A powder or cachet of 10 gr. of the drug should be given at once, and unless symptoms of mercurialism appear the dose should be cautiously increased to 15 or even 20 gr., and should be repeated every second or third day.

When calomel cannot be tolerated, oil of turpentine in 30 to 60 min. doses, three times daily, may be substituted, but its pungent odour and acrid taste are serious disadvantages. Capsules containing oil of turpentine either rupture too readily or they become hard and insoluble, and in hot climates they are specially unsatisfactory. An emulsion, prepared as follows, may generally be taken without much difficulty: 30 gr. of powdered gum acacia are rubbed up, first, with a fluid drachm of turpentine, and afterwards with an equal quantity of water, the mixture being gradually made up to an ounce by trituration with mist. amygdalæ [U.S.P. emulsium amygdalæ]. Half an ounce to an ounce is a suitable dose.

Salophen in 30-gr. doses, three or four times daily, may also be tried; it is tasteless, and, unlike most of the other phenyl derivatives, does not act as an irritant to the renal epithelium. Thymol, properly administered, is a powerful and reliable anthelmintic for mature parasites. After gentle purgation by castor oil or Karlsbad salts, and while the patient is still fasting, a cachet containing 20 gr. of powdered thymol should be given every two hours until three doses have been taken. During the administration of the drug the recumbent position should be maintained, and no stimulants or alkalies should be allowed.

Salol has also been shown to possess a directly toxic action on the parent worms. Preferably it should be given in liquid form, and it appears to be most effective when prescribed as an emulsion. The following is a convenient formula :

Dissolve 20 gr. of salol in a fluid drachm of liquid paraffin by the aid of heat ; while hot, triturate vigorously, and add 30 gr. of powdered gum acacia, afterwards making up to 1 fluid ounce with distilled water.

Toxæmia and other symptoms of tissue invasion may sometimes be alleviated by the administration of aspirin 15 to 20 gr., phenacetin 10 to 15 gr. or phenazone 20 to 25 gr., and hypodermic injections of morphia should be used freely if pain is severe. When there is high fever, heart failure is a frequent and early complication, and the general condition of the patient always demands special attention. Throughout the whole of the attack the strength must be carefully husbanded and nutrition must be aintained by judicious feeding and assiduous nursing. In the rly stages the diet should consist almost entirely of albumin ter, light soups, veal broth and extract of meat; later, arrowroot d farinaceous foods may be given in small quantities. When cessary, stimulants should be prescribed without hesitation.

W. CARNEGIE BROWN.

DISEASES AND AFFECTIONS OF THE EYES.

ERRORS OF REFRACTION AND ACCOMMODATION.

ANISOMETROPIA.

A DIFFERENCE in the refraction of the two eyes is more often met with than absolute equality, and in astigmatism it is very common to find a difference of ·25 or ·50 between them; in such cases it is more common than not, to find one meridian the same in both eyes.

(1) **Simultaneous Binocular Vision Exists.**—The treatment in these cases varies considerably. In young patients, if the difference between the eyes is not very great, each eye should be fitted with its correcting glass; but in older patients we must try the binocular effect before prescribing the glasses. Patients who have lived many years without having their anisometropia corrected have become so accustomed to the difference between the two eyes that the removal of the difference not only confers no benefit but proves irksome. Place the proper correction in front of each eye and try the binocular effect; if this is satisfactory, prescribe these glasses; if not, try various combinations.

We find generally that we have to reduce the strength of the glass before the more ametropic eye, and sometimes in addition to this we must increase the strength of the glass before the other. Full correction should be our aim, and we should get as near to it as we can, the patient's sensations being our guide. It is a good plan, when the correction has been found under a cycloplegic, to deduct a little more from the more ametropic eye and a little less from the other. For instance, supposing that under atropine a patient requires + 2 and + 5, he may prefer to wear + 1·5 and + 3·5.

(2) **The Eyes are used Alternately.**—One eye is emmetropic or slightly hyperopic and is used for distance, and the other myopic and used for near work. If eyestrain is not present, the patient may prefer to have no glasses. Although he has lost binocular vision he has gained other advantages; in some cases he can entirely dispense with muscular effort, his ciliary muscle and internal recti being rarely used. If eyestrain is present, we must prescribe glasses, after ascertaining the binocular combination that suits best. We sometimes find, that if, for instance, both eyes are

hyperopic, the patient prefers the same glass in both eyes, corresponding to that required by the most ametropic eye; this latter eye will then be used for distance and the other for near work. In the same manner, if both eyes are myopic, we give each the correcting glass of the weaker. In all these cases, the cylinder should never be altered, except in rare instances where there is a great difference in the astigmatism of the two eyes, and then the stronger cylinder may have to be reduced.

(3) **One Eye is Permanently Excluded from Vision.**—When the difference between the eyes is great, the more defective eye is little used and tends to become amblyopic if it be not so already. In such cases we must give each eye its proper correction, and instruct the patient to practise the amblyopic eye by totally excluding vision with the good eye by covering it with a patch for a certain time every day. In "amblyopia ex anopsia" occurring in patients with convergent strabismus this treatment, patiently persevered in, is often most satisfactory (*see* Hyperopia). Adults with only one useful eye may be allowed to wear a monocle if astigmatism is absent.

When presbyopia is present with anisometropia we should, whenever possible, prescribe bi-focal glasses. The lower reading section must be found by the same kind of trial as we made for the distant correction; it does not follow that the same addition is given to each eye.

When one eye is permanently excluded and the remaining eye is ametropic and presbyopic, as in aphakia after cataract extraction, reversible spectacles are useful; the distant correction is on one side and the reading on the other.

NOTE.—The only cycloplegics that need be employed in refraction work are atropine and homatropine, both of which are best used in the form of "tabloids" or discs. Ophthalmic tabloid "B" (Burroughs, Wellcome & Co.) contains atropine hydrobromide and cocaine hydrochloride $\frac{1}{200}$ gr. each, and ophthalmic tabloid "W" (Burroughs, Wellcome & Co.) contains $\frac{1}{50}$ gr. each of he hydrochloride of homatropine and cocaine.

Either drug may also be used in the form of drops. This is a cheaper method ut not so reliable, and in the case of atropine it may be followed by toxic ymptoms due to the passage of the drops down the tear passages to the throat. When atropine has to be used for some long period in young children the st form is that of the ointment, vaseline and atropine (4 gr. to the ounce) t up in a collapsible tube.

Atropine should be applied to the eyes twice a day for as many days as the of the patient indicates.

Homatropine (tabloid "W," Burroughs, Wellcome & Co.) should be applied ut an hour, or an hour and a quarter, before the examination, and when an itional effect is required (as in the case of young adults who cannot give up time required by atropine) a second tabloid should be applied a quarter of our after the first.

or the various methods of diagnosing and estimating errors of refraction reader may consult the writer's text-book on "Refraction of the Eye," lition (Bailliere, Tindal & Cox).

APHAKIA.

A convex glass of 11D in the spectacle frame is about the equivalent of the lens in the eye, so that an emmetrope who becomes aphakic requires a + 11D with which to see distant objects clearly, and as all accommodation is lost we must add to this the equivalent of the accommodation effort for near vision; thus to read at 33 millimètres, he requires 11 + 3 = 14D, and at 25 centimètres 11 + 4 = 15D. After cataract extraction there is almost always a large amount of "inverse" astigmatism, and a cylinder + 1·5 or + 2D, placed horizontally, is generally required. As the astigmatism tends to become less for some weeks after the operation the prescription of permanent glasses should be delayed for about three months. When a cylinder is required the glass is sometimes best given in the sphero-toric form.

If the patient was originally ametropic, the following is an approximate guide for the selection of the glass required; halve the amount of the original error and add to it + 11. Thus, with a hyperope of 4, the cataract distance glass will probably be 11 + 2 = 13; in a myope of 10, 11 − 5 = + 6. A myope of about 22, probably requires *no* distance glass.

Failure to get a satisfactory correction may be due to an opaque capsule which needs needling.

Bi-focals or reversible glasses may be worn according to the wish of the patient.

ASTIGMATISM.

Regular Astigmatism.—The treatment of astigmatism would be fairly simple if the cornea were the only seat of astigmatism, but the crystalline lens may also be astigmatic and the astigmatism may be *static* or *dynamic*. Static lenticular astigmatism is generally of the same kind as the corneal, and, added to the latter, increases the total astigmatism of the eye. Dynamic astigmatism is nearly always corrective and is the opposite of that of the cornea. It is produced by an unequal contraction of the ciliary muscle, and is the result of the craving for clear vision. It should be borne in mind that it is only quite low degrees of astigmatism of the cornea that can be corrected by this dynamic astigmatism of the lens, and also that this irregular work done by the ciliary muscle is a constant drain on the nervous energy of the individual, and is also a constant cause of reflex irritation (*see* Eyestrain). Thus it seems almost unnecessary to add that all those engaged in refrac work should observe two important rules:

First Rule.—Always suspect the presence of astigmatism.

Second Rule.—Never be satisfied that astigmatism is eliminated unless the examination has been made under a cycloplegic in all under forty or forty-five years of age.

There is no refractive error in which cycloplegics are of such paramount importance as in astigmatism of a small amount. The ciliary muscle has formed a bad habit (of which the patient is often quite unconscious) and only gives up this habit when forced to do so by being paralysed.

Cylindrical lenses correct regular astigmatism of the cornea, and, when the error is small, do the work that the ciliary muscle has been doing at so great a cost to the nervous system. When the error is large, certainly when it is over ·75D, the ciliary muscle cannot correct the defect, and consequently makes no attempt to do so, but the greatest care must be exercised in giving the exact cylinder that corrects the defect, because, if a small portion is left uncorrected, the ciliary muscle can do the rest of the work, and strain results. For instance, by retinoscopy we find an eye with the horizontal meridian showing + 4, and the vertical + 2. We find that a cylinder + 2 axis vertical, and a sphere + 2 gives $\frac{6}{6}$, and when the effects of the cycloplegic have passed off we give, say, cylinder + 2D and + 1 sphere. Had we been a little more careful we should have found that the best result was obtained by a cylinder + 2·25 and this ·25 we have omitted to correct is corrected by the lens, and we introduce eyestrain which did not exist before.

The estimation of astigmatism is made by (1) the ophthalmometer; (2) the shadow test; and (3) the final trial of glasses before Snellen's types placed at 6 mètres from the patient. Armed with the knowledge of the refraction of the principal meridians and the direction of the axis, this final test is very easy. The difference between the two meridians represents the strength of the cylinder, and the spherical glass is represented by the refraction of the weakest meridian; thus, when the horizontal meridian is – 4 and the vertical – 6, we take a cylinder – 2, place its axis to correspond with the least ametropic meridian (in this case the horizontal), and combine it with a spherical glass – 4. In mixed astigmatism the selection of the glasses is a little more complicated. As before, the difference in refraction of the two meridians equals the amount of the astigmatism. Supposing the horizontal is + 3 and the vertical – 2, the amount of the astigmatism is 5. Now, we can use either a concave cylinder and convex sphere, or *vice versâ*, and sometimes it is as well to try both kinds in order to see which is preferred. Let us in this case take a

− 5 cylinder and place it in the trial frames with the axis horizontal (*i.e.*, at right angles to the myopic meridian) and correct the hyperopia with a + 3 sphere. When the patient recovers from the cycloplegic this sphere will have to be reduced to + 2 or even + 1·5. As a general rule, it is best to choose the cylinder that corrects the most defective meridian. For instance, the vertical meridian is − 1 and the horizontal + 4. Here select a + 5 cylinder, set vertically, combined with a − 1 sphere, which may have to be strengthened to − 1·5 when the cycloplegic has passed off. (The optician should be instructed to set the concave glass next the eye in order to obtain a periscopic effect.)

The rule in mixed astigmatism is: The cylinder represents the difference between the two meridians, with its axis at right angles to the meridian whose sign it corresponds to, and the spherical glass should be the value of the meridian whose sign is the opposite of the cylinder.

In testing the patient under a cycloplegic with the trial glasses 6 metres from Snellen's type, we may have to add or subtract from the various glasses, sphericals or cylindricals, to obtain the best result, and the best position of the axis of the cylinder may be a few degrees different from what the retinoscopy or the ophthalmometer indicated, but we must remember that the subjective examination must always have the "last word," the objective examination being our guide and never our master.

Another important rule to be observed in the treatment of astigmatism is that it should be *fully corrected*, and when the patient has recovered from the cycloplegic neither the power nor the axis of the cylinder should be altered, although we may have to deduct from, or add to, the spherical lens. The exceptions to this rule are few, and are as follows: (1) In children under seven years of age, when the astigmatism is less than ·5, no cylinder need be ordered if no symptom of eyestrain is present; (2) in patients over, say, forty years of age, who have never had their astigmatism corrected and who require a high cylinder, as this latter may give discomfort at first, a slight reduction may be made in the power; but the full correction should be given, as soon as possible, later.

In examining patients for astigmatism, atropine should be previously used up to the age of twenty-five, and even up to the age of thirty-five if a low error is suspected; homatropine is sufficient for older patients; after forty-five or fifty no cycloplegic is necessary.

NOTE.—So important is it when treating small errors of astigmatism to correct even the smallest amount, that the trial case should be fitted with cylinders representing fractions of ·12 up to 1D, *i.e.*, in addition to ·25, ·50, ·75, there should also be ·12, ·37, ·62, and ·87, cylinders.

Irregular Astigmatism.—Place before the eye in a trial frame an opaque disc with a small central opening (stenopaic disc), shift the position of the opening and put up also different lenses. If vision is improved, prescribe stenopaic spectacles with the lens if indicated, and if the opening is eccentric, specify the amount of decentering. In conical cornea this treatment is sometimes beneficial, but unfortunately, in most cases, the spectacle treatment of irregular astigmatism is useless. As regular astigmatism may also be present, it is worth while making the above examination with a stenopaic *slit*, turning it round in different positions to see if any improvement results, with or without the addition of a convex or concave spherical lens.

If the defect is caused by a corneal nebula, and especially if the patient is young and the opacity not too dense, considerable improvement sometimes follows the use of the yellow oxide of mercury ointment, a small piece of which should be rubbed into the cornea, by massage through the upper lid, about twice a week.

CYCLOPLEGIA.

The treatment of cycloplegia naturally depends on the cause.

If due to a strong cycloplegic, such as atropine, the paralysis lasts from eight to fifteen days; if due to a weak one, such as homatropine, about six to twelve hours. The restoration to the normal may be accelerated by the use of eserine.

When the accommodation is paralysed after diphtheria, it generally occurs in young subjects, is bilateral, and may follow a most insignificant attack of the disease. The patient is in the same condition as an old person who has lost all accommodation, and the treatment is practically the same. If he is emmetropic, reading glasses only are necessary, and the weakest convex glass with which reading is possible should be prescribed in order to encourage the ciliary muscle to act, and these glasses should be changed for still weaker ones as the power returns to the muscle. When an error of refraction is present, bi-focal glasses for distance and near vision must be ordered (*see* Presbyopia).

As dilated pupils from iridoplegia sometimes co-exist with cycloplegia, considerable improvement in vision may result from the use of a drop of eserine in the eyes every morning.

When cycloplegia results from any other cause, the aforesaid treatment should be adopted, combined with the internal administration of iodide of potash, or strychnine, etc., as may be indicated.

EYESTRAIN.

Eyestrain is a symptom, or group of symptoms, produced by the correction or attempt at correction by the ciliary muscle of an error of refraction, or a want of balance between the external muscles of the eyes. When gross errors exist, either in the refraction or in the muscular equilibrium the patient cannot correct, and consequently makes no attempt to correct, the defect, and eyestrain is not produced. The smaller the error the more likely is the eyestrain to be present, and also, unfortunately for the patient, the more likely is it to be overlooked.

It is important to recognise what may be the different manifestations of eyestrain. They may be grouped under three headings:

(1) Manifestations on the eye and lids, such as conjunctivitis, blepharitis, iritis, cyclitis, glaucoma and cataract.

(2) Peripheral Irritation: (*a*) With pain: Headaches and migraine; (*b*) Without pain: Epileptic attacks and choreiform movements of the facial muscles, vertigo, nausea, vomiting.

(3) Nerve waste, nerve exhaustion, neurasthenia, brain-fag.

This last form of eyestrain is as common as it is subtle. It is subtle, because the patient never suspects the eyes to be at fault; all his waking hours he is unconsciously correcting a low degree of astigmatism or anisometropia or heterophoria, which means a constant waste of nervous energy, and when he begins near work he starts with a big deficit, and further strain results.

Insomnia is a prominent symptom of eyestrain; this leads to depression, which, in its turn, may lead to the alcoholic or morphia habit. There is no form of functional nerve disorder that may not be caused by, or aggravated by, eyestrain.

After these remarks, it seems hardly necessary to add that the treatment of eyestrain consists in correcting all errors of refraction (and in the case of astigmatism and anisometropia, even the smallest) and in wearing the correction always. A small amount of heterophoria will generally, in a short time, disappear when the error is corrected; if not, it must be corrected by prisms or decentering (*see* Heterophoria).

"Neurasthenic" patients should not be allowed to do any near work at first; later, when they have become accustomed to their glasses, they may be permitted to read for short periods, which can be gradually increased as improvement takes place.

In all these cases, as eyestrain may not be the only factor present the general health should be attended to.

HYPERMETROPIA, OR HYPEROPIA.

As the treatment varies with the age of the patient we shall consider its application accordingly.

Up to Six Years of Age.—Atropine should be applied to the eyes for *at least* three days, preferably for a week, twice a day, before the examination.

During this period of life the eye has not fully developed, and most children have a certain amount of hyperopia, which should only be corrected if high or if *strabismus* is present.

As the examination before the type at this age is generally impracticable, the surgeon has to depend on the result of his retinoscopy.

The glasses ordered should be at least 2D weaker than the atropine estimate, and when the error is greater even more must be deducted. The correction of hyperopia, in those who have developed convergent strabismus, has often the happiest results, for the squint may be cured without resorting to an operation, and the success is in direct ratio to the youth of the patient. Moreover, these are the hyperopes who can most readily be made practically "emmetropic," and therefore obtain the greatest benefit from the glasses; for their very defect, the squint, shows that they have been unable to dissociate their accommodation and convergence. It is this habit of using their accommodation in excess which has led to hypertrophy of the ciliary muscle, which prevents many hyperopes from taking full correction. They cannot overcome the habit, and naturally the older the patient the lesser the probability is there of this being possible. In such cases a weak convex glass must be given at first, and its strength increased later. When the amplitude of accommodation is great the patient will probably prefer a weaker glass than we wish to give, and *vice versâ*. When the hyperopia is small in amount, and equal in the two eyes, and there is no strabismus, it is generally unnecessary to order any glass.

From Ages Six to Fifteen.—The atropine should be applied to the eyes twice daily for at least two days, and preferably three days, before the examination.

By this time the eye should be emmetropic, and as the child is entering the active period of school career, the hyperopia should be corrected unless *very small* in amount, and even then, when associated with astigmatism.

At this period we must recognise the "personal equation." Some patients will stand a fuller correction of their defect than others.

After ascertaining the amount of error under atropine we must, whenever possible, arrange for a final examination before the test types, when the effects of the cycloplegic have passed off. We should prescribe the highest correction the patient will accept, consistent with good vision. For instance, under atropine a child of twelve years reads $\frac{6}{6}$ with + 3. When the effects of the atropine have passed off, deducting + 1 for the atropine, we find that + 2 gives $\frac{6}{9}$ hazily, and that it is only when we reach + 1·25, that $\frac{6}{6}$ is clearly read. This is the correction we order, with a cylinder correcting the astigmatism if present (*see* Astigmatism). We must remember that such a patient did not come to us for improvement in vision, he probably read $\frac{6}{6}$ quite well, and if we insist on his wearing a correction which makes his distant vision worse, he will seize every opportunity of not wearing the glasses.

When the hyperopia is slight (say, only 1·75 or 2 under atropine), equal in the two eyes and unassociated with astigmatism or strabismus, glasses *are not necessary*.

From Ages Fifteen to Twenty-five or Thirty.—Atropine is the best cycloplegic, but in a large number of cases we have to be content with homatropine, because atropine necessitates too long a period of rest from work. Glasses should not be prescribed until the patient has recovered from the effects of the cycloplegic, and then the fullest correction of the error that the patient will accept, consistent with good vision, should be ordered to be worn always. When the patient cannot return for a final visit, glasses correcting the whole of the manifest and about one-third of the latent hyperopia may be safely prescribed. (Manifest hyperopia is expressed in amount by the *strongest* convex glass the patient accepts when not under atropine. Latent hyperopia is the additional hyperopia which is revealed under atropine.) In high hyperopia, especially in cases where the patient will only accept a very partial correction of the error, it is advisable to give the full atropine correction, as special near-work glasses, for use by artificial light.

From Ages Thirty to Forty-five.—Homatropine should be used as the cycloplegic, and in the case of patients with high hyperopia, or when the smallest fear of glaucoma is present, one drop of eserine (2 gr. to the ounce) should be put into the eyes when the examination is finished. The treatment is the same as for younger patients. A larger proportion of the correction will be accepted, and the older the patient the more necessary is it to give the full cycloplegic correction for near work.

Over Age Forty-five.—No cycloplegic is necessary, as all the hyperopia has by this time become manifest. The strongest convex glass the patient will accept must be prescribed, and as the presbyopic period has arrived, a still stronger glass will be required for reading, and the two are best prescribed in one glass in the form of invisible bi-focals (*see* Presbyopia).

MYOPIA.

In early life the treatment of myopia is mostly preventive. It is rare to come across a child under six years of age with actual myopia.

Apparent myopia may show itself, (*a*) from spasm of the ciliary muscle, distant vision being subnormal and improved by concave glasses, and near work being brought very near to the eyes; (*b*) in a young patient with high hyperopia, in which case distant vision is poor, and near work is held very near to the eyes in order to acquire large retinal images; (*c*) in children who have acquired the habit of holding their work near the eyes, either through faulty illumination or on account of reduced visual acuity produced by some disease of the eyes, such as a corneal nebula.

In all these cases the true error is revealed by a cycloplegic, consequently no attempt should ever be made to treat a young myope without previously paralysing the accommodation, and atropine should, if possible, always be used.

The preventive treatment is more especially indicated in all children whose parents are myopic, for they have probably inherited an "anatomical predisposition" to myopia.

Bearing in mind that excessive convergence is the most potent cause of myopia, the most rigid attention should be paid to **ophthalmic hygiene**. The schoolroom should be lofty and large, and have high windows on one wall, preferably on the north side. The seats and desks should be arranged in rows, so that the students sit with the windows on their left. When practicable, each scholar should have an adjustable seat and desk, but when this cannot be arranged, as most children of the same age are of the same height while sitting and in the same class, the height of the desk from the seat should increase gradually with the classes, the highest class having the highest desks. The desks should be so adjusted that the pupil's head is upright and the work not too near the eyes.

The school work that needs close application of the eyes should be continued only for a short period at a time, the period alternating with other work which does not require the use of the eyes, such as mental arithmetic, blackboard demonstrations, recitation or play. School books should be clearly printed and the type must not be too small.

Schoolmasters should teach more, that is, they should explain and impart knowledge by demonstrations and simple lectures, and reduce as much as possible the time spent in " home preparation," which is usually work done by bad light and when the student is physically and mentally tired.

Even in the nursery the greatest care should be taken. The little ones should have large toys, a large box of plain wooden bricks being the best form ; picture books should be discouraged ; they should not be allowed to sew, thread beads, nor in fact do anything which entails undue convergence. The nursery governess can teach them their letters and small words, and even simple arithmetic, by means of the wooden bricks.

No child with a tendency to myopia or with a myopic family history should be allowed to learn to write or to draw until at least seven years old.

The child's bed should not be allowed to face the window ; preferably it should be back to the light.

Having ascertained the concave glass that corrects the myopia of each eye under atropine, we may, in quite young patients, order such glasses for constant use ; in those over puberty it is wise to delay prescribing until the effects of the atropine have passed off ; not only because an increase of ·5 may very distinctly improve vision, but because it is important to try the glasses binocularly when the eye is in the normal state. It is too often forgotten that the eyes are not single optical instruments, and we often find that a *weaker* concave pair of glasses give as good vision as a stronger glass used monocularly.

The only certain method of arresting the progress of myopia is to establish a normal state, in which the ciliary muscle is strengthened by being forced to work, the excess of convergence over accommodation stopped, and excessive convergence made impossible, and this can only be achieved by insisting upon the *constant* use of the glasses and *refusing to give weaker ones for near work*. The patient can see his near work so much better *without glasses* that we may have some trouble at first in enforcing this treatment. Of, course, the precaution must be taken of removing the glasses when rough games are being played.

In adults the treatment of myopia should be carried out in the same manner, substituting homatropine for atropine in those who cannot afford the time from work that the latter entails.

If the myopia is somewhat high, say 6D or over, and has never been fully corrected, we may have to give glasses for near work 1·5 or 2D weaker, but the patient should be strongly advised only to wear these on special occasions when fine work is being done or by artificial light. The older the patient and the higher the myopia the more difficult will it be for him to use the distance glasses for near work, because his accommodation has been so long idle that the ciliary muscle is considerably atrophied.

If the patient is a student, or engaged in literary or other work which entails close application for many hours a day, and if he is free to regulate his work, he should be advised to work for shorter periods and take longer intervals of rest, and be especially careful to have his work always in a good light.

In patients of thirty years of age and up to forty homatropine should be used when practicable. Over forty no cycloplegic is required. If the patient has never had the full correction he will, at this age, be unable to read with his distance glasses, and weaker ones must be given, preferably in the form of bi-focals. All the more will this be the case when he arrives at forty or forty-five, the emmetrope's presbyopic period; no rigid rule should be observed, but each case should be treated according to its requirements. After carefully testing the patient we should find his working near point, and keep more accommodation in reserve than would be required in the emmetrope, because the ciliary muscle is weaker (*see* Presbyopia).

Some adults with a small amount of myopia obstinately refuse to wear the constant correction—ladies will wear lorgnettes at the theatre, etc., men will wear a monocle; if no astigmatism is present, this may be allowed so long as no increase in the myopia takes place, but only on the condition that the patient is re-examined at frequent intervals.

High Myopia.—The treatment of high myopia is somewhat different. When the young adult has never worn the full correction, it will be useless to prescribe it, even for distance, at first. We should reduce the glass as little as possible and test binoculary. For instance, the myopia may be 20 in both eyes, but − 18 before each eye is the strongest glass the patient will tolerate. These we order for constant use, and we may find that later the full correction will be accepted. In older patients, not only have we to be satisfied with a reduction in the distance glasses, but we must often take off as much as 4 D for near work.

When recent fundus changes are present in young patients, the eyes should be kept under atropine for a long period, the correcting glasses should be well tinted, and a country open-air life should be strongly recommended, with complete cessation of all close work while the changes are active. As retinal or choroidal hæmorrhages may occur in older patients, they should be warned against stooping or straining, and should be strongly advised to do little, if any, near work. In all these cases so much depends on the general health that it is wise for the surgeon to place them under the care of a physician, who, among other things, can advise as to aperients, the means of reducing high blood pressure when present, etc.

Detachment of the retina is the most disastrous sequela that may occur in high myopia; when it does occur, little or nothing can be done for it and the eye is lost. When any fear exists as to the possibility of detachment ensuing, the patient should be specially warned against riding on horseback, jumping, or doing any act that may jar the body.

The Treatment of High Myopia by Discission and Removal of the Lens.—When the patient is not older than twenty-five, the myopia very high, vision very poor and not improved by glasses beyond $\frac{6}{24}$, and when the fundus changes are not very marked, and especially when the myopia is progressive, the lens may be removed by discission. The improvement is sometimes very great, the patient being able to see better without a glass than he did previously with a strong concave lens. (For details of this treatment the reader should consult a text-book on Ophthalmology.)

PRESBYOPIA.

Two classes of patients come to us for treatment; one class simply requests glasses for reading (some of these have been to various opticians and have not been suited, and we very often find them suffering from incipient cataract); the other class comes complaining of some symptom of eyestrain, and they may or may not be aware that they require glasses.

A cycloplegic is rarely necessary (except in isolated cases where our results are unsatisfactory, or we wish to examine the lens for cataract) because ciliary spasm is very unlikely to be present, and latent hyperopia, when present, is becoming or has become manifest. We first ascertain the distant correction and then the near point of distinct vision, and the most comfortable distance for reading or working. Suppose distant vision is normal and the punctum proximum is 28 centimètres, and the distance at which the patient wishes to read is 33 centimètres. His amplitude of accommodation is $\frac{100}{28} = 3{\cdot}5\text{D}$. To avoid fatigue he must not use the whole of this, but must keep about one-third in reserve. Let him have 1·5D in reserve, this leaves him 2D available accommodative power, and as he requires 3D we supply the deficit by giving him + 1D glasses. The treatment, simple as it appears, is not always successful, because the accommodative power varies with the individual and when it is weak a greater reserve has to be left. We generally find that an emmetrope of about forty-eight requires a reading glass of + 1D, and an additional + 1 for every five years.

When ametropia is present the distance correction must be ascertained and the presbyopic glasses added to it. Thus, if the distance glass is + 2, and an addition of + 1·5 is required for reading, the reading glass is + 3·5; if the distance correction is — 4, and an addition of + 2 is required for reading, the reading glass is — 2. When astigmatism is present the correcting cylinder must, of course, be added.

It was the custom until quite recently for presbyopes who have fairly normal distant vision to be provided with reading glasses only, but we now recognise the importance of correcting all errors of refraction, especially at this period of life, so that unless the patient is an emmetrope he will require glasses for distance as well as near work. This double correction is best prescribed in the form of "bi-focal" spectacles or pince-nez, where the upper part is used for distance and the lower for reading. These bi-focals are now made so that the division between the two portions is invisible, and it is no exaggeration to assert that they have completely revolutionised the treatment of presbyopia. They should be prescribed for all patients who have the slightest error of refraction in addition to their presbyopia if they show any sign of eyestrain or nerve waste. On the other hand, those who live an open-air life, whose distant vision is practically normal and who enjoy good health, may be allowed to have reading glasses only.

As the bi-focals have to be used for writing as well as reading, it is very important that the lower section be not too strong; it is rarely necessary at any time of life to wear a stronger addition than 3D; should the patient want a stronger reading glass for evening, it must be prescribed as a separate glass. As an alternative to bi-focals the reading "addition" may be mounted in pince-nez or "hook fronts," to be worn in front of the distance glasses when reading.

When so-called "music" glasses for near work at arm's length are wanted they should be selected by testing the patient at the required distance; these glasses are generally from 1D to 1·5D weaker than the reading glasses.

SPASM OF ACCOMMODATION.

Spasm of accommodation is the opposite of cycloplegia, and may be (1) a temporary spasm, soon passing off with rest, or (2) a persistent spasm, generally associated with hyperopia in young people and producing a false myopia (*see* Myopia). Both forms are the result of strain of the ciliary muscle, and are, with rare exceptions, cured by the use of a cycloplegic and the correction of the error of refraction.

SPECTACLES.

The treatment of errors of refraction cannot be considered to be complete unless the optician has accurately made up the prescription; consequently it is very important for the surgeon to check the glasses and their fit; if practicable, this should never be omitted.

The optical centre of the glass should coincide with the visual axis.

Distance glasses should be centered for distance, and near work glasses for the point at which they are intended to be used; glasses for constant use should be centered for a point between these two. If the centering is wrong, a prismatic effect obtains, and discomfort or eyestrain will result.

The plane of the glasses should be perpendicular to the visual axis when in use; hence reading glasses must be tilted forwards.

The saddle bridge is the best form of bridge for spectacles; it should fit the nose accurately and not allow the glasses to slip.

The clips which keep pince-nez in position on the nose should be made of malleable material, so that they can be shaped to the sides of the nose.

It is most important that all glasses should "sit" horizontally; especially is this the case when cylinders are worn.

The lenses must be as near the eyes as the lashes will permit, but these latter must on no account touch the glass. When the lashes are very long. periscopic glasses should be ordered.

Children should always have spectacles and the frame ought to be strong and light. Under no circumstances should anyone but an emmetropic presbyope be allowed to wear "folders."

Final Note.—Patients ought always to be reminded that the treatment of their error of refraction is by no means permanent. Changes will take place. Young patients should be re-examined at least once a year—older patients every two or three years.

ERNEST CLARKE.

AMBLYOPIA AND FUNCTIONAL DISEASES.

Amblyopia, congenital or acquired, without organic lesions, should be treated by functional use. The eyes usually have refractive errors, chiefly hypermetropic or astigmatic, and these errors should be corrected by glasses and the glasses worn always, if treatment, which is often unnecessary or undesirable, is decided on. Frequently, while one eye is amblyopic, its fellow has vision above the normal. In cases of squint the non-fixing eye is frequently amblyopic. In order to train its function, it is necessary to tie up the good eye for an hour or more every day in the case of children. This procedure is extremely irksome, and the treatment can best be carried on at meal-times and by reserving the best toys for functional exercise of the amblyopic eye. Stereoscopic exercise, by means of Worth's amblyoscope, is especially valuable in the case of squint. Though normal vision is probably never secured, yet the standard of visual acuity can be very much raised by this procedure.

Toxic amblyopia induced by tobacco can only be successfully treated by absolute disuse of tobacco in any shape or form. The affection generally comes on about the age of fifty, when the patient has been subject to some mental strain; and relief from anxiety, when it can be obtained, is of the greatest importance in the treatment of the condition. Strychnine is a useful drug, and may be given with advantage. The trouble has generally been going on to a slight degree for several months, when rapid failure occurs in the course of a few weeks. This rapid failure is recovered from as quickly as it is lost, but for complete recovery three months' treatment at least is nearly always necessary, but so long as the patient continues to smoke complete cure is impossible. After recovery, he may be allowed to smoke with moderation and only light tobaccos.

The amblyopia that occurs from alcoholism chiefly produces peripheral loss of the field of vision, but central vision is also affected. The treatment for this condition is that required for the alcoholic habit. No local treatment is of any use, except protection of the eyes with dark glasses from the exhausting effects of excessively bright light. The amblyopia, combined with great restriction of vision, that results from quinine poisoning, only improves very slowly, and probably never recovers completely. It results from great constriction of the retinal vessels and consequent starvation of the retina. Treatment should be directed to the circulatory system, and inhalation of nitrite of amyl may possibly be of use. The amblyopia that results from wood spirit and carbon disulphide must be treated in the same way, especial care being taken that the poisonous influences be avoided. Amblyopia resulting from high degrees of myopia gives little scope for treatment, but the use of the eyes under proper hygienic conditions must be insisted on. Low degrees of functional myopia that make their appearance in young people, especially in girls suffering from anæmia, disappear completely under a course of iron. The amblyopia that results from diseases of the retina and choroid due to organic changes that occur can only be checked by prompt treatment of the disease that gives rise to such changes.

Functional night-blindness that occurs in children and is associated with a certain form of conjunctivitis calls for the treatment of the conjunctival condition, and especially of the general health, for these patients always appear to be suffering from malnutrition.

The amblyopia of various kinds that occurs in hysteria requires the general treatment that is indicated in that condition. The difficulty in these cases is the diagnosis. It is important that no organic lesion should be overlooked, for, as in other conditions of hysteria, the functional amblyopia due to that cause may be associated with some organic trouble. Snow-blindness may be guarded against by protecting the eyes with dark glasses under conditions that are likely to produce it.

Word-blindness, word-dumbness, are due to defects in the brain, and the difficulty can generally be overcome to some extent by great perseverance in teaching. Nothing but this is of any avail. The method of learning to read introduced by Miss Mason, by which words are learnt as a whole instead of by building them up with letters and syllables, is of great use in this condition. Various reading boxes can be obtained from her at 56, Grosvenor Road, Herne Hill, S.E.

Functional Troubles of the Eyes are mainly due to refractiv and muscle-balance errors leading to strain of the ciliary muscle or the external muscles controlling the movements of the eye, but it must not be forgotten that functional trouble may occur with eyes that are anatomically normal in those whose health is lowered from any cause. Headache, browache, pain at the back of the eye, is alway associated with ciliary muscle trouble, and pain at the nape of th neck very often with muscle-balance errors. The treatment o these troubles is mainly correction of the errors that exist, for which *see* Refraction, but it must not be thought necessary to correct errors simply because they exist. Spectacles are a great disability, and often it would be better to develop the tone of the ciliary muscle by regular exercise, so that it can perform the extra work it is called upon to do, rather than to relieve it of its extra work by correcting the error and thereby placing the patient under the necessity of wearing glasses. This is very frequently forgotten or not recognised. Headaches are very often caused by refractive errors, but in these cases relief cannot be expected with any certainty from the use of glasses unless they are worn always. It is well, however, to try if the use of glasses merely for near work when the strain is greatest is sufficient to relieve them, before imprisoning the patient permanently behind glasses.

Migraine is frequently associated with refractive errors, though this is not always the case. They should be carefully corrected and glasses worn always, should the frequency of the attacks demand it. As with headaches, no certainty as to giving relief can be looked for unless the glasses are worn always, but in some cases their use when the strain is greatest has been of advantage. In functional troubles arising from the use of the eyes, whether there are refractive or muscle-balance errors or not, it should be borne in mind that the treatment is exercise and not rest. Practitioners so often tell patients when their eyes ache that they should rest them, and on following this advice the patient finds that the aching ceases, and doctor and patient congratulate themselves on the success of the treatment. Nothing, however, could be worse. The patient is merely converted into a chronic invalid, so far as his eyes are concerned. The treatment that should be adopted is regular functional use every day—the same treatment that an athlete gives himself when he is training for a race. Because his legs ache when he has run his first course he does not go to bed for a week to qualify for running again, but he gradually does a little more and more until he can attain his object without undue fatigue. The same line of reasoning should be applied to eyes. Beginning with a small amount of use each day and gradually and slowly increasing the amount, the muscles can be developed so that the patient can do, without undue distress, that which a few weeks before he would have thought impossible. A large number of people who believe themselves to be incapable of using their eyes except to a very limited extent could obtain a very much larger measure of enjoyment from their eyes if this course were more generally adopted. The functional discomfort that is produced by a bright light should be treated by inducing the patient to wear a shady hat or to use a sunshade. Dark glasses, as a rule, are bad. No harm would be done if the patient wears them when the light is most intense, but what happens is that they are worn at all times, so that, instead of the light being made equable, all conditions are toned down by a certain amount, so that the asthenopia is enormously increased when the patient happens to be without his glasses. Dark glasses should be looked upon as an extraordinary means for moderating intense light, and they should only be used under extraordinary conditions, such as climbing snow mountains. Should there be any organic disease of the retina it is a different matter, but it is a curious fact that often in these cases it is a difficult matter to persuade the patient to wear dark glasses.

R. W. DOYNE.

DISEASES AND AFFECTIONS OF THE CONJUNCTIVA.

INJURIES OF THE CONJUNCTIVA.

Wounds of the conjunctiva heal very rapidly and rarely require much attention if the deeper parts have escaped injury; if the laceration is extensive the edges may be brought together with fine sutures.

Burns of the conjunctiva are of varying character; splashes of molten metal are not infrequent, and usually do little damage; I have on more than one occasion removed from the eye a thin plate of lead cast in the shape of the globe. But there never has been any serious burn.

Much more severe are the chemical burns from acids or alkalies. It is usually stated that these should be treated by their neutralisation. Certainly, if a neutralising fluid is at hand ready mixed, it would be used with advantage, but the active substances, in most cases, work their full effect on the eye within a few seconds of their entrance, and it is probably better to employ these seconds in washing the eye out with copious streams of water than to waste the most precious opportunity of limiting their action in the search for the antidote. The quantity of active reagent which enters an eye is necessarily small, and therefore its action is soon ended.

When the reagent is solid, as, for example, lime, there is a longer time of action, and it may be justifiable to mix a weak solution of vinegar to wash out the conjunctiva, but even in these cases much may be done by removing the solid, piecemeal, with a spud and irrigating with quantities of water. Then, when the neutralising solution has been prepared, it may be made use of.

To subdue pain we may use cocaine or dionine. After the immediate pain is ended, we must guard against the formation of adhesions between the eye and the lid, by the use of oil, by passing a probe daily round the *cul-de-sac* and breaking down the new adhesions as they form, and by causing the patient to wear a glass shell over the eye; it is said, by Fortunati, that the application of an ointment of picric acid (2 per cent.) after previous cocainisation, twice or thrice a day, is very efficacious in the prevention of adhesions and the limitation of corneal opacities.[1]

When opacities have formed little can be done to remove them, especially when the active agent has been lime; burns from ammonia sometimes clear remarkably; fibrolysin has been used, but with little effect.

Symblepharon must be dealt with by operation; when possible, some transplanting method, such as Teale's, should be chosen, by which unburnt conjunctiva is shifted to cover the raw surface left after the division of the adhesions. If there is not enough healthy conjunctiva to allow this, the wound must be covered either with mucous membrane from the mouth, or from some animal, or by a Thiersch graft of epithelium from the skin. The dealing with extensive symblephara is a difficult and often unsatisfactory task. The *cul-de-sacs* often remain shallow in spite of every attempt to reform them.

DISEASES OF THE CONJUNCTIVA.

All inflammations of the conjunctiva with purulent or muco-purulent discharge are probably infectious, and certain points in treatment are common, not only to them but to other non-infectious inflammations. It is not possible, within the prescribed limits of this article, to lay down minute directions and to give in full the prescriptions (which would indeed entail much repetition) for the treatment of every individual form of conjunctivitis, and therefore it seems more convenient to give as an introduction some **general rules and prescriptions in common use** and to add detailed instruction on such points as require it.

Any patient suffering from a muco-purulent or purulent conjunctivitis must be isolated as far as is practicable, and care must be taken that towels, handkerchiefs, etc., used by him are kept for him alone. When making any application to the inflamed eye no brush or sponge should be used; mops of cotton-wool, which can be immediately burnt, are infinitely preferable.

The eye bath, as a means of applying lotions, is not very objectionable; it can be easily sterilised by boiling; but when lotions have to be used many patients find a douche more comfortable, and there can be no doubt that it is more efficient; the best form of douche is the glass "Undine." For the material of the douche we need some astringent antiseptic; the least irritating, and that most generally useful, is the solution of boracic acid (5 gr. to 10 gr. to the ounce). Another frequently employed drug is borate of soda; this is often combined with aq. camphor., thus: ℞. Sodæ Boratis, gr. 10; Aquæ Camphoræ, ℥ij; Aquam, ad ℥j [U.S.P. ℞. Sodæ Boratis, gr. 10; Aquæ Camphoræ, ʒss; Aquam, ad ℥j]. Many surgeons add as an analgesic: Acid. Hydrocyanic Dil., ♏½ ad ℥j, or Chloretone, gr. ¾ ad ℥j.

If a stronger drug is thought necessary (and we must remember that some surgeons regard all strong metallic astringents as more potent for harm than good), we have a large choice before us, the salts of zinc, alum, copper, silver and mercury being in common use; as a general rule, lead salts should not be applied to the conjunctiva; if the corneal epithelium is broken the lead enters into a combination which forms an opaque deposit in the corneal tissue, and this is hardly removable.

The salts of zinc, especially the sulphate and the chloride, are often used in the treatment of conjunctivitis; they are usually employed in strength of ½ gr. or 1 gr. to the ounce; if they occasion much discomfort a weaker solution may be used, or we may combine them with some analgesic.

The following are useful combinations: ℞. Zinci Sulphatis, gr. ½; Acidi Borici, gr. 5; Aquæ Laurocerasi, ʒj; Aquam, ad ℥j. ℞. Zinci Chloridi, gr. ½; Acidi Borici, gr. 5; Liquor. Morphin. Hydrochlor., ♏2; Aquam, ad ℥j. [U.S.P. ℞. Zinci Chloride, gr. ½; Acidi Borici, gr. 5; Morphin. Hydrochlor., gr. $\frac{1}{55}$; Aquam, ad ℥j.] It is doubted by some surgeons whether the morphine is absorbed by the conjunctiva, and, therefore, whether it has any effect; clinical experience seems to point to its alleviating the discomfort.

Chloretone, already mentioned in a preceding prescription, is in most cases a very useful analgesic; it is also an antiseptic. Cocaine was much used as an adjuvant to astringents at one time; its use has been shown to be objectionable for more than one reason; though it reduces the discomfort, it also lessens the sensibility of the cornea, and thus may allow it to receive, unnoticed, serious injury; further, it loosens the epithelium of the cornea, so that it is cast off, leaving the substantia propria bare; lastly, it dilates the pupil, and has occasionally excited or precipitated an attack of glaucoma.

Temporarily to relieve pain, cocaine is invaluable, but its use must be regulated with great care; the other similar substances, eucaine, novocaine, etc., mostly excite hyperæmia, and are therefore contra-indicated when astringents are needed.

The use of alum (usual strength 2 gr. ad 1 oz.) is almost limited to those cases in which the hyperæmia is the prominent symptom and the discharge is small; copper is not often used except in trachoma, but silver and mercury are of value in almost every one of the conjunctival inflammations.

The silver salt formerly in constant demand was the nitrate;

this has a powerful action, both bactericidal and caustic. The pain of its application was considerable, and there was always fear that the action of the drug would occasion local destruction; it was therefore always neutralised, after an interval, by a solution of sodium chloride. The tendency of modern pharmacy has been to combine the metallic base with some organic radicle, and in this way to avoid the destruction due to the mineral acid. Thus the inorganic nitrate of silver has been largely replaced in the armamentarium of the ophthalmic surgeon by argyrol, protargol, etc., which are more safely handled (by the patient himself, if need be), and though less active may be used more frequently and copiously. It is important to remember that the solutions of these new salts must be fresh; they may be used in any strength up to 33 per cent.; if the solution is for the patient's own application, 10 per cent. is usual.

There is one risk; if the use of any silver salt is continued for very long the conjunctiva may be permanently stained; this is more frequent if the solution is allowed to remain long in contact with the cornea at any application. It is therefore a good plan to insist that a free douche should be given to the eye one minute after every application of silver. It was at one time stated that the organic silver compounds did not cause argyriasis. This is certainly not true, but their use can be prolonged with the precaution named for many months without any staining; it is also said that the stain is less permanent than that following the nitrate, but this is not proved.[2]

The silver and also the copper salts are not often used as lotions, but are dropped into the eye in comparatively concentrated solution. One or two drops only are instilled at any time.

Following the general tendency, the inorganic zinc salts have been replaced to some extent by "nizin," zinc sulphanilate, and among the mercurial salts sublimate [U.S.P. corrosive mercuric chloride] has given way to the oxycyanide, and to "sublamine." The sublimate was very ill-borne by the eye, even in solution so weak as 1 in 8,000; sublamine, which is slightly alkaline, gives rise to hardly any discomfort, even in solution of 1 in 1,000, and its bactericidal power is stated to be very great; it seems, therefore, to be an ideal salt of mercury for eyework. I have made considerable use of it, and have found it satisfactory.

Physiological organic astringents, adrenalin, etc., from which much was expected when the active bodies were first isolated, have proved of little curative value in most conditions; they may be used occasionally, without any idea of cure, to remove, for a time, the redness of conjunctivitis, but it must be borne in mind that the prolonged use of adrenalin has been followed in some cases by permanent softening and disorganisation of the eye.

Vegetable astringents, tannin, hamamelis, etc., are prescribed by many surgeons, especially for very chronic hyperæmic conditions with little discharge; their action is not very marked.

Ointments are not often applied to the conjunctiva, but often to the lid margins, to prevent their sticking together and holding in the discharge.

Catarrhal Conjunctivitis.—The more exact processes of research, and especially bacteriology, have divided this, which used to be regarded as one disease, into several. Success in treatment must depend largely on accurate diagnosis; this, in turn, depends on the accurate employment of all methods of investigation.

Chronic hyperæmia of the conjunctiva with little discharge is often the result of some error of refraction or muscle balance; unless such error is recognised and corrected accurately, treatment by means of drugs can be no more than palliative. Some very troublesome cases of a similar kind are found in gouty subjects, and are then very difficult to cure. Most, however, are helped by lotions of boric acid or sodium borate; some yield to the application of silver or copper; many cannot bear the use of zinc salts in any but the weakest solutions (gr. $\frac{1}{16}$ ad ℥j). Treatment of the general condition on which the local depends must not be forgotten.

Of the specific forms the two most marked are the acute inflammation due to the Koch-Weeks' bacillus, and the more chronic due to the diplobacillus of Morax-Axenfeld. The former condition is associated with rather copious discharge of muco-pus, and with the presence of small hæmorrhages in the conjunctiva; the latter has less discharge and the redness is especially marked about the canthi, from which fact comes its common name, "angular conjunctivitis." For this condition, zinc salts are a specific remedy, and for the former they are, at least, a valuable adjuvant; this accounts for their routine employment in all such catarrhs.

Since the two diseases commonly give rise to small epidemics in schools and families, all possible precautions must be taken against infection; the danger of the disease is small, but the inconvenience considerable.

Treatment resolves itself into the frequent douching with weak zinc and boric acid solutions and occasional painting with silver; it is said that the diplobacillary conjunctivitis (of Morax) is unfavourably affected by silver; this has not been my own experience. Protargol is most useful. It is of service to apply an ointment, either simple vaseline or, if preferred, some astringent ointment, such as ung. acid. boric. or ung. zinci, to the lid margins to prevent their sticking together and penning up the discharge.

Many similar cases follow the exanthemata, especially measles; their treatment is that given above. Occasionally the chronic cases resist all usual treatment; in some I have found it useful to vaccinate with a culture of their own bacteria; but the cases are not many, and the results, though encouraging, too few to base conclusions on.

When any conjunctivitis has endured for a long time the lymph follicles in the submucosa become increased in size and number; this hyperplasia gives rise to a condition which is sometimes regarded as an early stage of trachoma; there is, however, no doubt that follicular conjunctivitis, as it is called, has no real relationship to that disease. Treatment is often prolonged; Stephenson and others recommend the insertion of a small piece of lead ointment within the lids twice daily, to be followed by external massage. The risk of lead opacity when the corneal epithelium is broken must not be forgotten.

A local disturbance of the conjunctiva on the inner side of the eye, which at first sight closely resembles a localised catarrh, is not infrequently seen as the result of the lodgment in the canaliculus of a fragment of cut hair; the sharp end, protruding from the punctum, is a constant source of irritation, and gives rise to an intractable conjunctivitis, which may go on indefinitely, unless the cause is observed.

The continued use of atropine may give rise to an inflammation of the lids and conjunctiva which is characteristic; treatment consists in omitting the mydriatic, and applying astringents.

Phlyctenular Conjunctivitis.—In children of the strumous type any conjunctivitis is apt to be associated with the presence of small papules on the ocular conjunctiva and especially on the actual limbus corneæ. These papules are called phlyctenulæ; they frequently break down on the surface and become ulcers; in the papular stage they occasion small discomfort, but when the surface is broken there is often severe photophobia and spasm of the orbicularis. It is not certain whether these papules are really tuberculous or not; after it has been for years definitely stated that they are never tuberculous, it has recently been declared that they are, at least in some cases, true tubercles.

The treatment of the general health is important; the children are almost always weakly and ill-fed. They often are suffering from local eczema, or from rhinitis, and the ocular condition is often the result of conveyed infection: ℞. Atropin. gr. ½; Hydrargyr. Oxid. Flav., gr. 1; Adipis Lanæ Hydros., Paraffin. Moll. Alb., āā gr. 120.

For the phlyctenules the yellow oxide ointment is almost a specific remedy; if there is photophobia it may be combined with atropine, and if there is much blepharospasm it may be necessary o divide the orbicularis at the outer canthus, so as to put the muscle at rest. When the symptom is present it is rarely possible o examine the eye thoroughly without the use of a general næsthetic, and if one is given it affords a favourable opportunity or the division.

The eye must be bathed with boric acid solution; the general con-ition demands cod-liver oil, maltine and the syrup of iodide of iron. he child must be well cared for and should live in the open air as much as possible. The eyes may be shielded but not bandaged.

It has been found by Nias and Paton[3] that the appearance of hlyctenules and their course have a close relation to the state of esistance against the tubercle bacillus.

The blepharospasm is frequently associated with a small linear lcer at the outer canthus.

Ophthalmia Neonatorum. — The treatment of ophthalmia eonatorum ought to be almost entirely prophylactic. It has been und an easy matter, by the universal adoption of simple prophy-ctics, either after the manner of Credé or in some way slightly odified from his, to reduce the disease to vanishing point in all ell-managed lying-in hospitals, and it should equally disappear tside these institutions. It is strange that some practitioners pose the enforced adoption of this most beneficent practice on e ground that, by its use, we are making imputations against the orality of the parents; even if this were so, it should surely not eigh against the risk of blindness to the child; and a moment's flection should show that it is not so. We need only point out at some 33 per cent. of all cases of this disease are due to some use other than the gonococcus to make evident the baselessness this assumption, and when we have further pointed out that redé's method of prophylaxis is equally efficacious against the ther forms, which are often of almost equal danger, it seems nnecessary to say more.

The essential part of all protective methods is cleanliness, accompanied by the instillation of some silver salt.

Credé's instructions included careful cleansing of the vagina, whenever there was a discharge present, for some days before parturition. After birth the eyes are carefully wiped dry with a piece of sterile gauze; then the lids are opened and a drop of the solution of silver nitrate (2 per cent.) is dropped into the eye.

The one disadvantage of this method is that the silver sets up a somewhat violent reaction in some cases, which may be mistaken for the very disease which it wards off; the organic compounds which we have mentioned seem to be equally efficient prophylactics and do not give rise to the after-reaction.

Should the disease develop in spite of or in the absence of prophylaxis, or should the child be born, as rarely happens, with the disease fully developed, contrary to that which we find in the adult, the two eyes are usually infected. If only one is attacked the other must be disinfected with some silver salt, to abort the disease if infection has just occurred, and protected against future inoculation. It is not easy to apply either a protective bandage or a Buller's shield (*vide infra*, Gonorrhœal Ophthalmia in the Adult) satisfactorily, and some surgeons recommend, as the simplest and most efficient plan, that the baby should be kept lying on the side of the affected eye and the unaffected eye instilled with argyrol, at least once a day.

Treatment of the infected eye must aim at removing the discharge as speedily as it forms and limiting the inflammation by the use of some silver salt; the surgeon should in this, as in all other infective conditions, protect his own eyes by means of goggles while he paints or washes the infant's eyes. The neglect of this obvious precaution has been in some cases followed by grave consequences.

The whole surface of the conjunctiva must be irrigated copiously by some douche containing warm weak boric acid, normal saline or sodium bicarbonate. The mechanical cleansing is of more importance than the antiseptic, and therefore the amount of the lavage is to be considered more than the nature. The removal of the discharge is by no means easy, and, if necessary, the douche may be supplemented by mops of wool; these must be very lightly handled, for a small lesion of the corneal epithelium may be enough to allow the invasion of micro-organisms, which will totally destroy the eye. Some surgeons use for the douche a 1 in 4,000 solution of potassium permanganate, or sublamine (1 in 2,000).

After every douche a drop of 25 per cent. argyrol solution should be instilled into the eye. This may be repeated every half-hour.

When nitrate of silver is used its application cannot be made more often than daily, because of the destruction of the superficial layers of the conjunctival epithelium.

It will be found that the discharge usually diminishes in a few days. When this occurs the argyrol must not be diminished *pari passu;* if it is lessened too soon there will often be a relapse, which is more difficult to deal with than the primary disease. If this occurs, the daily use of silver nitrate is often necessary in addition to the argyrol.

The chief danger is infection of the cornea, and through this of the whole eye. If the cornea becomes hazy it is significant of danger. The persistent removal of the discharge must be effected with redoubled care; it seems often of value to give instillations of eserine sulphate (gr. 1 ad ℥j); this seems to improve the nutrition of the cornea and helps to preserve it. Dionine, also, has a beneficial action.

If an ulcer forms, it must be disinfected by antiseptic ointments, *e.g.*, iodoform, and if it does not immediately heal, by touching with carbolic acid or the galvano-cautery.

In cases where the ulceration still spreads a section through the floor of the ulcer after the manner of Saemisch, though a desperate remedy, will sometimes save the eye from total loss. In such circumstances, Walker, of Liverpool, recommends multiple incision of the corneal margin with a narrow bent kerotome, "kerotomy."

Terlinck and Adam speak highly of an ointment of basic aluminium acetate, "lenicet," as a routine treatment of all gonococcal cases. The strength advised is 10 per cent. in a mixture of white vaseline, lanoline and cerosine.[4] This has not been approved of by most surgeons.

Gonorrhœal Ophthalmia in the Adult.—In the adult, gonorrhœal ophthalmia is of varying intensity, but in the large majority of cases is a disease much to be feared. The disease is almost always due to contagion from the patient himself, and the severity varies inversely with the length of time since the primary infection. In view of the gravity, no patients with gonorrhœa should be left unwarned of the risk of ocular infection.

It is, as a general rule, unilateral. When one eye only is attacked the fellow eye must be carefully disinfected by means of protargol or argyrol, and closed from further risk with a *Buller's Shield.* To make this we need a watch-glass and two squares of adhesive plaster, with a side 2 inches long, and a circular hole in the centre of each, having a diameter about ¼ inch less than the watch-glass. The glass is then placed between the two squares, so that it is held by its edge all round; the surfaces of the plaster adhere together over the rest of their area.

The shield thus made is fastened over the eye by strips of plaster along the eyebrow, cheek and nose. The lower edge may with advantage be left largely free. The glass forms a window through which the patient can see and the surgeon inspect the eye at will without uncovering it.

If the whole circumference is fastened with plaster, the perspiration dims the glass and prevents the patient's and the surgeon's view.

If no materials to make a shield are at hand, the eye may be closed temporarily with a protective bandage, but the shield should be obtained as soon as possible. The disease is a most depressing one, and if to the patient's misery we add the occlusion of the sound eye, we may interfere seriously with his chance of recovery. Further the protective bandage must be removed at least once a day to allow inspection of the eye, and at this moment infection is possible.

Not until the sound eye is protected should we begin the treatment of the infected eye; this, as in the infantile form, consists in the frequent removal of all pus and instillation of silver. Sometimes the swollen lids prevent the efficient use of the douche; in such a case it is often well to divide the canthus, or even, if necessary, the upper lid in its whole width from top to bottom.

In this way the cornea is exposed, and can be watched and tended; the great danger is partial or total death of the cornea, and we must take all possible measures to guard against this.

If the surface becomes rough and the epithelium hazy, it is a sign of imminent danger; eserine drops will sometimes be of service; they appear to act by increasing the vascularity of the part.

Dionine, though it improves the vitality by increasing the flow of blood and lymph through the anterior segment of the eye, has the serious drawback that it causes chemosis; for this reason its value is limited in these cases, because an increase of chemosis increases the difficulty of removing the pus. Free scarification of the conjunctiva will allow the fluid causing the chemosis to escape, and is often of value. Darier recommends, under similar circumstances, and indeed in all severe cases, opening the lids wide and filling the lake with argyrol solution, which is allowed to soak all the tissues for some minutes. Others have suggested the plan of building a dam round the outer wall of the orbit with glazier's putty, so that the argyrol is better retained.

It is reported that many cases may be aborted in this way.

Should the cornea be infected there will be seen a dirty grey patch, probably near the edge, which soon becomes an abscess or an ulcer. This may be treated as suggested under the heading of Ophthalmia Neonatorum; the prognosis is more grave in the adult.

When the discharge ceases the lids are left thickened and rough; the appearance resembles trachoma. Treatment by astringents will gradually bring the lids back to normal; though there may be a few linear scars, there will be no serious contraction as in trachoma.

Cases of severe purulent conjunctivitis are occasionally met with, in which the exciting organism is the streptococcus pyogenes, or some other organism; they must be treated on the same lines as true gonorrhœal ophthalmia.

Diphtheritic Conjunctivitis.—A form of purulent ophthalmia due to the infection of diphtheria was formerly almost as redoubtable as gonorrhœal conjunctivitis. Since the adoption of antitoxin it is rarely seen. If the conjunctival is the primary infection, the nature of the disease will be easily recognised by bacterial examination; the antitoxin treatment will usually bring about an early cure. The local remedies are the same as those used for the gonococcal disease.

Trachoma.—In the early stages of trachoma the diagnosis of the disease from other forms of conjunctivitis is practically impossible. There is no known characteristic micro-organism by which separation can be made, and the clinical features present no distinguishing features until the characteristic "granules" can be seen. The treatment, therefore, in the earliest stages, must be on the same lines as that for any muco-purulent ophthalmia, viz., frequent and copious lavage with weak astringents and instillation of some silver salt.

If infection is known to have occurred, or to be antecedently most probable, the best solution for lavage is perhaps Hydrarg. Perchlor. (1 in 1,000) pars 1; Aquæ, partes 3. *Sig.*: Mix with equal quantities of warm water and bathe the eye freely every two hours.

Except in those localities where trachoma is endemic, infection can rarely be recognised, and when there is doubt, it is preferable not to use the mercurial salt, but some such solution as the following: Zinci Chloridi, gr. 5; Acidi Borici, gr. 50; Liquor Morphinæ Hydrochloratis, ♏20; Aquam, ad Oss. [U.S.P. Zinci Chloridi, gr. 5; Acidi Borici, gr. 50; Morphin. Hydrochlor., gr. $\frac{1}{5}$; Aquam, ad Oss.] In addition there should be instilled into the eye, whether infection is suspected or not, a solution of argyrol (10 or 20 per cent.) every two hours. By these means, many cases which have been tentatively diagnosed as trachomatous, from the papillary condition of the conjunctiva of the upper lid, have subsided within a few weeks.

In true trachoma, the appearance of the lids soon becomes characteristic. Now, when the granulations are large and prominent, much may be done to cut short the disease and to limit the formation of scar tissue. The granules (sago-grain bodies) are the precursors of fibrous tissue, and it is the object of treatment to get rid of them before they have had time to become organised.

To effect this some operative manipulation is necessary; the best instrument is Knapp's roller forceps.

A general anæsthetic is usually wanted, for the pain is considerable. The operator must protect his own eyes by means of goggles against a chance spurt of infective matter from the patient's eye.

The lid is everted and the follicles are pricked one by one by means of any knife; it is useful to instil adrenalin, in order that the bleeding may not obscure the field of operation. Then, when all the follicles are incised, the surgeon grasps the lid in the forceps, placing one blade in the *cul-de-sac* and the other on the exposed surface, and slowly draws the forceps downward across the lid, squeezing out, as it passes, the contents of the granules.

This is repeated until the whole surface of the lid has been rolled. When the follicles are empty a strong antiseptic solution may be brushed forcibly into them; a solution of corrosive sublimate (2 or even 4 per cent.) may be rubbed with a stiff brush into the conjunctiva.

There is surprisingly little after-pain as a rule; the lid is swollen for a day or two, during which no strong applications can be made. Cold lavage with weak boracic acid, or 1 in 10,000 oxycyanide, is very useful in this stage; the lotion may, if preferred, be iced.

After three or four days the treatment by means of argyrol and astringents may be resumed.

The follicles often reappear, and the expression must be repeated as often as necessary; it is the chief object of our treatment to limit the hyperplasia of the conjunctiva as much as possible.

If the early stage of the disease has passed we find the papillæ much hypertrophied and the new material converted largely into scar tissue; it is not then possible to express anything from the granules, and the course of treatment must be to remove them by caustics and astringents as thoroughly as possible. This can best be done by the systematic use of copper sulphate; if, on the first visit, the outgrowths are seen to be firm and solid, consisting of organised connective tissue, it often hastens relief to give a general anæsthetic and to rub down the papillæ with a smooth crystal of the pure salt until the resulting surface of the lid is level. On account of the great pain a general anæsthetic must be given. No further applications of powerful drugs can be borne for a few days, but within a week the lid may be everted and every sprouting granulation touched with the copper crystal or with the diluted "lapis divinus." This should be repeated twice a week or oftener if possible; some patients become clever at everting their own lids and applying copper for themselves; between the applications of the caustic, astringent lotions, and an ointment of citrate of copper, the so-called cupro-citrol ointment (5 per cent.), should be used. This treatment must be continued for years; the surgeon must always be on the look out for fresh granules and be prepared to attack them as they arise.

If the cornea becomes involved and vascularised we should divide the conjunctiva surrounding it and the vessels running to it; it sometimes is of advantage to draw a ring round the limbus with the galvano-cautery. If corneal ulcers appear the pain is often severe; all strong measures must be dropped until the ulcer has healed; an ointment containing iodoform, atropine and dionine, has given me the best results.

In the late stages of the disease there is often cicatricial deformity of the lids producing entropion and trichiasis; the correction of this demands operation, which will be dealt with under the section of Diseases of the Lids.

Ginestous uses the following formula: ℞. Cupri Sulph. Pulverat., part. 2; Orthoform., Holocain. Hydrochlor., Tragacanth., āā part. 1; Aquæ, q.s. *Sig.*: Roll into pencils. The holocain, which is anæsthetic, and the orthoform, which stops deep pain, make the application hardly uncomfortable.

Sometimes in the late stages of the disease the cornea remains very vascular and opaque; de Wecker suggested many years ago the use of jequirity in 0·5 per cent. infusion; the instillation of this liquid brings on a purulent conjunctivitis which, as it clears up, leaves the cornea much less vascular and more transparent. The dangers of serious ulceration, however, caused the drug to fall into disuse. Recently Römer has standardised the reagent under the name of "jequiritol," and has also obtained an anti-serum which is able to limit the action of the reagent if it appear excessive; this has been little used in England, but is much recommended by Casey Wood.[5]

Exposure to the X-rays and to radium has been recommended; the results do not seem to be permanent, and in some cases are unfavourable.

Pedrazzoli (Riv. Ital. di Ottalmologia, March, 1907) strongly recommends the use of tachiol (fluoride of silver). He uses it in the following way: he everts the conjunctival surface as much as possible and sprays it with a 1 in 1,000 solution of the drug. As a preliminary measure he often begins by rubbing the lid with a mop of wool dipped first into the solution and then into powdered crystals of boric acid; the crystals scarify the surface and allow the silver to enter the follicles.

Quite recently it has been proposed to use pencils of frozen carbon dioxide ("CO_2 Snow") as a local application to trachomatous lids. The lid is cocainised, and the pencil, held in some non-conducting material, is pressed for 10 or 15 seconds against the trachomatous surface. I have used this on one or two patients, and have thought it successful; the patients did not like it, as the after-pain is somewhat severe. In one case it was followed by slight but rather persistent œdema. The applications cannot be made more than once in a week or ten days.[6]

Spring Catarrh.—Spring catarrh, formerly one of the most obstinate of all conjunctival conditions, second only to trachoma in its persistence, has recently been robbed of much of its terrors by the use of radium.

Formerly astringents, and especially adrenalin, were the chief agents of treatment, and in mild cases the latter gave many gratifying results; but relapses were common and in the more severe forms adrenalin frequently failed even to relieve.

Tuberculosis of the Conjunctiva is rather rare; it is usually a complication of tuberculosis elsewhere, but it may apparently be the primary lesion. Treatment should be largely surgical: the tubercles should be removed by the sharp spoon. When this has been done exposure to the X-rays is very efficacious; to complete the cure, the raw surface left after the scraping may be dressed with iodoform, and a weak solution of formol is recommended as lotion.

Snow Blindness.—**Electric Conjunctivitis.**—These forms conjunctivitis seem due to the irritation of the ultra-violet ligh They may be largely prevented by the use of suitable goggles of dar or "Fieuzel"-green glass. When they occur cold applications of weak zinc lotions give great relief.

Pterygium.—The treatment of this condition is purely surgical and consists in transplanting the apex of the growth from the cornea to a bed prepared for it under the conjunctiva at some little distance from the old attachment.

Xerosis.—For the xerosis of the conjunctiva due to cicatricial conditions which follow severe trachoma or pemphigus there is not much to be done; the disease goes on slowly but inevitably to complete blindness; something may be effected by means of instillation of oil, to relieve the discomfort; it has been suggested that we might replace the secretion of the mucous glands which is wanting by the instillation of a solution of mucine, but this has not seemed to give as much relief to the patients as the drop of oil.

For the xerosis which accompanies night-blindness in children it is usually enough to improve the nutrition and especially to give plenty of green vegetables; the xerotic patches can easily be treated and removed by oily applications, but the patches will recur as long as the general health remains below par; it is well to remember that the bacillus xerosis, which is found in these cases, is not responsible for the condition, but is merely present by coincidence.

In the grave cases, when xerosis is complicated by general destruction of the cornea, keratomalacia, the disturbance of general health is much more severe, and the marasmus is often fatal.

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TUMOURS OF THE CONJUNCTIVA.

DERMOID tumours of the conjunctiva can, if not very large, be removed with the conjunctiva to which they are attached. However, when this would entail too great a loss of conjunctiva, they must be left. Pigmented moles on the conjunctiva should be removed, because they are liable to be the seat of malignant growths. They are easily removed with the conjunctiva on which they are situated by snipping them off with scissors, and the resulting wound is left to heal by granulation. Small nævi can be treated in the same way.

Papillomata sometimes occur at the sclero-corneal margin, and they can be removed by shaving them off with a Beer's knife, together with the conjunctiva immediately adjoining them. After removal they should be carefully examined microscopically, because sarcomata and epitheliomata both grow in this region, and the former bears a strong resemblance in the early stages to simple papilloma. In the case of these malignant growths they should be carefully removed with a knife. It is well also to cauterise the site with the galvano-cautery. If there is the slightest appearance of recurrence the writer would advise removal of the eyeball. The malignancy of these growths is often very great, and attempts to save the eye have often led to tragedies which probably might have been prevented had early and complete removal of the orbital contents been resorted to. This, however, is an extreme view, and it is right to point out that many surgeons are satisfied to remove locally again and again the recurrence of the growth. Epithelioma and rodent ulcer invade the conjunctiva, but will be spoken of under Tumours of the Orbit.

R. W. DOYNE.

DISEASES AND AFFECTIONS OF THE CORNEA.

Conical Cornea.—This defect of curvature of the cornea is secondary to an imperfect development of that membrane; the conical cornea is always too thin in the part which yields. We may, therefore, in the early stages attempt (but often without success) to stop the progress, by improving the general nutrition; when the cone is fairly established, high cylindrical glasses may be found which will greatly sharpen vision, but they can be found only by experiment. Frequently a change of the curvature will soon make the glasses useless. When no correction can be found, some surgical measures must be taken to alter the curvature, either by excising a small piece of the cone or by producing a scar on the surface, which will, by its contraction, flatten the deformity.

The first method of operation, by removal of a piece of the cornea, is difficult and dangerous, but the results, when successful, are brilliant; the other method, though uncertain, is at least free from risk, and is that commonly adopted now.

Treatment by pressure bandages has been tried, but without any marked effect.

Dermoid of the Cornea occurs as a small white island of skin riding on the corneal limbus; the only treatment is removal.

Ulcer.—Ulcers of the cornea occur in many different forms, some of which may be considered under one general heading, while others require special mention. Generally an ulcer is the result of some injury, often slight, which removes the epithelium of the cornea; the severity of the disease depends not so much on the degree of the injury, but on the presence or absence of micro-organisms; when the wound has been occasioned by a sterile body, as often happens when hot splinters of metal wound the cornea, the damage is usually small and the time of convalescence short, while the treatment is simple.

If, on the other hand, the fragment which causes the wound is infected with dangerous organisms, the smallest lesion is serious, and may be followed by the gravest consequences.

This is so well known that where these accidents are common special names are given to the conditions following them; thus, in Southern France, there is "chestnut gatherer's keratitis," which follows the scratches from the spines of chestnuts; in America, there is "oyster shucker's keratitis," following the injuries from fragments of the shells; and the dangers of flying splinters of stone to road menders is well known here, though it has not given rise to any special name.

In simple ulcers, such as were referred to above, the surgeon should instil a little atropine into the eye to dilate the pupil and keep the iris at rest. The extent of the ulcer can be conveniently mapped out and investigated by the instillation of a minute drop of a 2 per cent. solution of fluorescein in an alkaline medium; this stains the surface of the cornea, where the epithelium has been removed, a bright green.

Irrigation by warm mild antiseptic lotions, such as boracic acid (2 per cent.) or very weak mercurial solutions, is advisable. An antiseptic ointment, ung. hydrarg. flav. (gr. 2, ad ℥j), or iodoform ointment (10 per cent.), may be with advantage placed inside the lids.

There is always some risk that during sleep the rough lids will adhere to the new grown epithelial cells and tear them from their bed as soon as the eye is opened. The greasy surface left after the ointment has been inserted is less likely to become adherent; this relapsing ulceration is very troublesome, and may follow the most trivial and superficial abrasion if care is not taken at the beginning. If the epithelial cells are torn from their adhesion once or twice they seem to lose the power of making a close union with the tissues, and therefore the recurrence of the abrasion is more easy after each such accident. The epithelium over the area which was abraded is prone to become detached and form a bulla; when the bulla bursts there is rather acute pain. Massage of the surface with dilute yellow ointment from the beginning seems to be the most efficient prevention of this accident.

When an ulcer is infected the base is greyish, or yellowish, and irregular; round the actually ulcerated surface there is a halo of infiltration, appearing as a haze of the corneal tissue. There is ciliary injection and usually pain, which may be severe.

After a time the iris takes part in the inflammatory process and there is hypopyon.

In the first stages we try to disinfect the ulcer and prevent further spread of the infiltration. The application of antiseptics, either as ointment or drops, and of atropine, to combat the iritis, is the routine treatment; if the infection is obviously grave stronger methods must be employed without delay; the ulcer may be disinfected by touching with pure carbolic acid, or by the use of the galvano-cautery.

Richard Williams recommends a solution of neutral quinine sulphate (2 gr. to the ounce), combined with 2 gr. of atropine sulphate. This is dropped into the eye frequently; it is often of great service.

Should the ulcer spread in spite of the treatment, a subconjunctival injection of mercurial cyanide will often assist the healing. This is specially praised by de Wecker.

In some obstinate cases, when the ulcer deepens and threatens perforation of the cornea, it is wise to cut through the floor of the ulcer. This procedure was originally recommended by Guthrie, and later, independently, by Saemisch. It is better than to allow the ulcer to perforate; it is not so apt to be followed by anterior synechia or prolapse of the iris, and by the reduction of the intra-ocular pressure the tension on the diseased part is lessened, the pain subsides, and the inflamed tissues, being at rest, have better chance of recovery.

The subsidence of the pain of ulceration is not always a good sign; when there has been extensive ulceration, as is common in gonorrhœal conjunctivitis, the sudden cessation of pain often means a large perforation, which will be followed in many instances by total loss.

If it is considered advisable to apply carbolic acid to the ulcer a little preparation is necessary; the acid to be used should be 95 per cent. in glycerine. It is applied by means of a small stick sharpened to a point; some acute-angled triangles of blotting paper must be at hand.

The eye is anæsthetised by means of cocaine or any other local anæsthetic, a speculum is inserted, and the surface of the ulcer is irrigated, and then carefully dried with the blotting paper. Then the wooden point, which has soaked in the carbolic, is applied carefully to each point of the advancing ulcer. For certain forms of ulcer, especially the dendritic, it is of assistance to stain the surface with fluorescein immediately before the application of the phenol.

The parts touched turn white, and thus the surgeon can easily see how much of the ulcer has been treated. The whole advancing edge, and often the floor of the ulcer, must be "stippled" over with the acid. Any excess must be carefully removed by means of the blotting paper, but if the wooden point used is not merely dipped but soaked in the solution, and allowed to drip before it is brought near the eye, there is not much risk of an excess of acid reaching the surface. Some surgeons use absolute alcohol for the same purpose and in the same way; there is no advantage, that I have seen, and one considerable disadvantage is that the after-pain (which is slight for carbolic acid) is severe after alcohol. The bactericidal power of alcohol is less than that of carbolic acid.

Another method of treating these severe ulcers is by means of ionisation. It has been found that electrified atoms of various agents penetrate deeply into the tissues, and this has been made use of to secure their greater effect. The agent adopted is usually zinc sulphate, in chemically pure solution of ¼ per cent. The patient lies on a couch, the eye is anæsthetised by cocaine (in some cases this is not necessary, as the immediate discomfort attending the process is slight), and the lids are separated by a speculum. The negative pole of an electric battery is connected to the patient's forearm by means of an armlet. The positive pole is connected with a pair of forceps, in which is held a mop of wool, dipped in the solution. This mop is placed and held in contact with the ulcer.

After it is in place the current is gently switched on, and gradually increased until a current of 2 milliampères is passing. (It is essential that a galvanometer be in the circuit, so that the surgeon may know accurately the strength of the current.) It is kept at this strength for one minute and then slowly reduced to zero. The position of the mop of wool must not be changed while the current is passing; any alteration of position may cause a break in the circuit, and a breaking shock which will be uncomfortable to the patient. So long as the directions are carried out as given no shock will be felt. The pain, which is not severe at the time, gradually increases after and may become rather intense for two or three hours.

Inasmuch as alkaloids behave as metals, the cocaine, if it has been instilled beforehand, will be carried deeply into the tissues and its anæsthetising effect will have been increased.

Treatment by means of vaccines has been used in corneal ulcer; it is best to use a vaccine made from the individual patient; this, however, takes time in the preparation, and the disease will rarely wait. Some surgeons use a stock vaccine or serum. On account of the rapidity of the course the treatment by vaccines is not so applicable to this as to most other septic conditions.

Mooren's Ulcer (Rodent Ulcer of the Cornea).—This serious ulceration is not, as its second name would seem to imply, carcinomatous. It begins usually as a marginal ulcer spreading slowly round the cornea. The central edge is thickened, uneven, and undermined, bearing some superficial resemblance to the edge of a true rodent ulcer. After weeks the ulcer gradually surrounds the whole cornea, and then the remaining central area often loses its transparency. Gradually the ulceration eats away the superficial layers, leaving the deeper, covered by a thin scar which seriously interferes with, though it does not entirely abolish, vision.

The treatment of this intractable affection is very difficult; sometimes the early ulcers heal with comparatively little difficulty under applications of carbolic acid. More frequently they progress; then it becomes necessary to cut away the whole undermined edge with scissors and a sharp spoon and to destroy the parts that are not accessible to this treatment with the actual cautery. Sometimes this will be followed by healing even in the most desperate cases, and when a small part of the cornea is left clear an iridectomy may give useful vision even though the pupil area is covered by scar of the ulceration. In some cases the treatment by zinc ions has given better results than any other.

Phlyctenular Ulceration.—Phlyctenular ulceration is a very common complication of phlyctenular conjunctivitis in children. It usually begins from a point at the margin, but later may occur as a papule in the middle of the cornea.

The individual phlyctenule usually yields readily to treatment by means of the yellow oxide of mercury combined with atropine: ℞. Hydrargyri Oxidi Flavi, gr. ½; Atropinæ, gr. ½; Adip. Lanæ Hydrosi, Paraffin. Moll., āā gr. 60. *Sig.*: place a small piece inside the eye twice daily.

The children are often delicate, and their general health can be improved by fresh air and cod-liver oil.

When the ulcers are situated in the cornea, they give rise to more trouble, both immediate and remote; there is often photophobia, which the atropine tends to relieve. If it does not, some local analgesic, such as dionine, may be added. If the photophobia continues long there will often be seen an elongated skin crack at the external angle, caused by irritation from the discharge; it is often necessary to divide the external canthus with the neighbouring part of the orbicularis before the spasm can be stopped. When there is much blepharospasm it is dangerous to attempt to examine the cornea by force; the pressure necessary to separate the lids may rupture the weakened cornea and do irreparable damage. If the surgeon wishes to inspect the ulcer an anæsthetic must be given; while the child is unconscious, the division of the external canthus may be performed.

A form of ulceration, which clinically resembles phlyctenular ulcer very closely, is sometimes met with associated with acne rosacea. It differs from the phlyctenular variety as regards treatment in that it resists all the mild remedies, but is often favourably influenced by the internal administration of arsenic.

Interstitial Keratitis.—This, one of the most common complications of hereditary syphilis, is only part of an inflammation which attacks also the whole of the uveal tract of the eye. A similar condition is found in certain other diseases, especially tuberculosis, but the tuberculous keratitis can often be distinguished clinically from the syphilitic by the grosser character of the maculæ on the cornea and the size and arrangement of the patches of "keratitis punctata."

The sufferer from hereditary syphilis will usually have other stigmata; if these are wanting, investigation by Wassermann's reaction will usually settle the question; rarely a mixed infection may confuse the diagnosis. It is curious that in the acquired form of the disease the cornea most commonly escapes.

It is probable that there is a latent choroiditis in these children which springs to new activity at the time when the keratitis bursts out. If, therefore, we find in a young child, who is obviously the victim of the hereditary disease, apparently obsolete changes in the fundus of one or both eyes, it seems right to put him on to a prolonged mild mercurial course, so that, if possible, we may ward off the attack which will otherwise come on at or about puberty. This treatment has, further, a marked benefit on the general health, and can be recommended on this account alone.

When the disease develops, it commonly attacks both eyes, though not at the same time; the disease may have run the greater part of its course in one eye before the fellow is attacked. It does not seem possible to ward off the attack in the second eye by mercurials after the disease has begun in the first.

It must be borne in mind that the keratitis is only a part of a diffuse inflammatory process; atropine must be given to keep the iris and ciliary muscle at rest. Treatment at home by mercurials, given either by the mouth or by inunction, is often disappointing; some surgeons discard them altogether and rely on cod-liver oil and other tonics; most, perhaps, combine these with some mercury and iodide.

Whatever be the value of mercurials internally, I am convinced that sub-conjunctival injections of cyanide of mercury, given in the early stages of the disease, are of great assistance in cutting the course short. I am in the habit of ordering injections of 2 or 3 min. twice a week of a 1 in 1,000 solution. These small injections, after cocaine, especially if mixed with acoine (1 per cent.), give rise to very little discomfort, and are borne by children without complaint.

Other forms of general treatment are recommended by other surgeons. Wray uses acetozone in doses of 3 gr. three times a day. Risley speaks highly of thyroid feeding in some cases.

I have no doubt that all recent cases are much improved by mercurials, and that the leucomata which remain after an efficient mercurial course are much less dense and therefore less damaging than those that may be seen when a severe case has been treated without mercurials.

While, then, one states that the results of mercurials are disappointing, one refers to the immediate and not to the late results; at St. George's Hospital we always use mercurials freely.

The arsenical preparations, orsudan and soamin, should be, in my opinion, banished from the treatment of inherited syphilis; there is always a considerable risk of destructive inflammation of the optic nerve attending their use, for which reason I never advise their employment even by adults; in adults the failure of vision may be noticed in time to stop the drug and to allow recovery before the nerve is permanently damaged, but in children with interstitial keratitis, whose vision is already very imperfect, the failure may pass without notice, and the little patient may become permanently blind as the result of a toxic optic atrophy. Ehrlich's new remedy, "606," seems to have little effect on the corneal manifestations of syphilis.

When pain is severe, continuous heat applied by means of a "muff-warmer," or by repeated hot fomentations, will often relieve; leeches and the instillation of dionine (5 per cent.) will sometimes have effect when heat fails; the dionine has a beneficial action by its lymphagogic power apart from the analgesia which it induces.

The opacities left clear slowly; in the later stages massage with the yellow oxide ointment with dionine is useful; I have not found sub-conjunctival injections of so great assistance in this period of the disease as in the earlier, but other surgeons have not had the same experience. Some fine nebulæ containing the remains of branching vessels are almost always permanent.

When pressed for a prognosis the surgeon must remember that though the cornea will almost certainly clear eventually, vision does not depend on the condition of this only, but may be affected by choroiditis or retinitis, which is a frequent concomitant affection.

Tuberculous Keratitis is probably not very rare; a good many cases which are diagnosed as interstitial keratitis and regarded as due to hereditary syphilis are probably caused by tuberculosis.

When it is diagnosed treatment by the appropriate general remedies, absolute rest in fresh air, cod-liver oil, etc., are indicated; in addition, it has been recommended to try injections of sterile air into the sub-conjunctival spaces.[1] The technique is simple; air is drawn into a syringe through a flame, which sterilises it completely, and is then injected into the tissues. If there are signs of tuberculous iritis, it has been suggested that the syringe should be only half filled with air and that the needle should be passed into the anterior chamber; some of the aqueous humour is then withdrawn into the syringe, and then, the body of the syringe being depressed so that the fluid falls away from the nozzle, the sterile air is injected in place of the fluid which has been withdrawn. This procedure is not entirely free from danger.

The sub-conjunctival injections give rise to very little reaction, and seem to have a definite effect on some forms of keratitis and episcleritis.[2]

Tuberculin injections have been employed in the treatment of this condition and have been followed in many cases by cure. I have tried them in several instances and have not been convinced that they exercised any marked effect on the eye disease. Many surgeons, however, speak highly of their power, and they seem, at the least, to have no unfavourable influence (*see* Vaccine Therapy, p. 291).

The employment of Calmette's reaction, to decide the nature of any ocular lesion, has been followed in several cases by serious inflammation, and its use has rightly been given up on that account by most English ophthalmologists.

Sclerosing Keratitis.—Certain forms of irido-cyclitis, especially those in rheumatic people, are sometimes complicated by an interstitial inflammation of the cornea, which results in the formation of a dense white scar. The cornea takes on an appearance resembling the sclerotic. The pain in these cases is often great; leeching, continuous heat, and dionine are the best remedies for local use; internally the various forms of salicylates may be given. The opacities are usually very persistent, but some clear under this treatment in an unexpected way.

It has been proposed to replace the opaque cornea by a normal one taken either from an animal, or from a human eye which has been excised, but so far these attempts have had little or no success.

Vascular Keratitis.—Superficial vascular keratitis, pannus, is corneal trachoma. Its treatment is, firstly, that of the conjunctival disease; when the whole cornea is thickly spread with vessels and the disease is of old standing, it may be justifiable to use *jequirity* to produce a purulent conjunctivitis, which, when it subsides, may leave the cornea much improved; it is said that the amount of inflammatory reaction can be arranged at will if the special preparation jequiritol and the antidote, jequirity-serum, are used. The danger of perforation has prevented the frequent use of this method.

A much safer, if less efficacious, method of reducing vascularity is by means of *peritomy*; an incision is made through the conjunctiva and the afferent vessels; if desired, the vessels of the sub-conjunctival tissue may be obliterated with the cautery.

Herpes Frontalis.—This condition often spreads to the cornea and gives rise to severe pain. The vesicles break and form ulcers, which are often very intractable. General treatment by means of Easton's syrup is often of value; sometimes arsenic is beneficial. Locally, atropine and eucaine or novocaine may be instilled. Cocaine should be avoided on account of its loosening the epithelium. Hot applications, especially dry heat, relieve. There is often some cyclitis and the intra-ocular tension may rise and occasion intense pain. Gentle massage, with leeching and purgation, will generally relieve this.

Opacities of the Cornea.—Opacities of the cornea are known as nebulæ when slight, as leucomata when more dense. They are for the most part the result of inflammation or ulceration of the cornea. They are therefore really scars. They interfere with vision both by diminishing the transparency and by altering the curvature of the cornea, making this irregular. Frequently this latter factor is more important than the former. The density of the scar of an ulcer diminishes for some time after its formation; in infants the most unpromising looking corneæ often clear up to a surprising extent. In adults, there is seldom the same renewal of transparency after ulceration, though the opacities left by non-ulcerative keratitis clear equally well.

Something can be done to promote clearing by the employment of any treatment which increases the lymph flow through the corneal tissues; the drug most generally used and most valuable is dionine; this may be used in the form of drops or ointment (3 or 5 per cent.). It must not be used too frequently or it loses all effect; twice a week, at night, is the best time of administering it.

Fibrolysin has likewise been employed to remove these opacities; it has not seemed to me to have so much effect as dionine.

Certain forms of opacity are the result of the deposit of metallic salts in the corneal tissue ; the most common is due to lead. If an acetate of lead lotion is applied to the cornea when the epithelium is broken, the lead is deposited in the superficial layers of the substantia propria in the form of an opaque insoluble carbonate. The appearance is that of dense chalky white scales with a rough surface; and this gives rise to intense irritation. The epithelium is imperfectly adherent over the mass. These opacities are very difficult to deal with; if the scales are removed by scraping, some of the corneal tissue in which they are embedded must be removed with them, and the resulting nebula will be very extensive; on the other hand, attempts to dissolve the lead have not been very successful.

Recently Guillery has published the results of treating these deposits with ammonium tartrate and chloride; and the result seems encouraging. He instils a strong solution of cocaine and then scrapes the corneal epithelium; after the epithelium is removed, the eye is immersed in a bath of the salt. This treatment is repeated as often as is necessary; the method is somewhat painful in spite of the free use of cocaine.

Marquez[3] recommends a similar treatment for the silver opacities which are found after the use of silver nitrate, but in place of the ammonium chloride he employs sodium hyposulphite.

The passage of electrified ions of chlorine has also been utilised in the endeavour to clear up the opacities left after corneal ulceration, and it is said the results have been very good in some few cases.

The routine method of application is similar to that described under the treatment of ulcers, but since the chlorine ions travel from the negative to the positive pole, the negative pole must be applied to the cornea.

The application must be repeated at intervals of about a fortnight for some months.

When the opacity is central and dense it may be possible to improve the vision by means of an iridectomy; the artificial pupil must be placed in the clearest part of the cornea as near the centre as possible. If the iridectomy is so peripheral as to uncover the edge of the lens there can be little improvement, as the refracting systems will be very irregular.

Should the whole cornea become opaque and bulge (staphyloma), the deformity may demand some cosmetic operation. In these cases Mules' operation can be performed with the greatest chance of success.

In this operation the contents of the eye are removed and an "artificial vitreous" of glass or gold is sewn into the cavity of the sclerotic. This heals and gives a large prominent stump, which transmits extensive movements to the artificial eye.

HAROLD B. GRIMSDALE.

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[1] Caralt, Archivos de Oftalmogia Hispano-Americanos, April, 1908.

[2] *Cf.* also Terson and Farnière, La Clinique Opthalmologique, July 25th, 1908.

[3] Archivos de Oftalmologia Hispano-Americanos, December, 1908.

DISEASES AND AFFECTIONS OF THE LACRYMAL GLAND.

THE lacrymal gland is practically exempt from disease; tumours are very rare, and adenitis almost equally so; occasionally in syphilis a chronic inflammatory thickening may simulate tumour, but the only affection which is not of great rarity is a retention cyst or, as it is called, **dacryops**; this is a thin-walled swelling in the region of the lacrymal gland, seen easily when the lid is everted. The treatment of this, as of all tumours of the lacrymal gland, is removal by surgical means.

Lacrymation from hypersecretion of tears is a very common and very intractable condition. The ducts are all perfect, but the irritable conjunctiva causes a secretion of tears on the smallest provocation. If the conjunctiva is made insensitive by means of local anæsthetics, the hypersecretion is stayed; but the constant application of these drugs is not without its own serious dangers. Astringents, on the other hand, have little permanent effect; a drop of adrenalin solution (1 in 4,000) or alum lotion (2 gr. to the ounce) may be used.

Some good can be gained by protecting the eyes mechanically by glasses correcting any refractive error, or by goggles; it is often recommended to dilate the punctum, but this has rarely, if ever, in my experience, given any satisfactory result.

Blocking of the Excretory Passages may occur at any part of their course. The puncta are sometimes mal-developed or absent. If too small, they may be dilated by means of Nettleship's dilator; if absent, an attempt may be made to re-form them, but unless one punctum is present this is very difficult. When one is patent, a fine probe may be passed along the canaliculus, round into the canaliculus of the affected punctum, and, its point being felt near the surface, may be cut down on.

Sometimes the canaliculi are blocked by a concretion; this may be formed round a foreign body, such as an eyelash, for example, or be made up of a mass of fungi (leptothrix). The punctum must be dilated and the concretion removed.

Occasionally we find in infants a purulent discharge from one eye, which may simulate ophthalmia neonatorum, but which is really due to blocking of the nasal duct. In such cases the swelling over the sac, and the regurgitation of muco-purulent fluid on pressure on this region, will make the diagnosis plain.

This blocking is generally due to the retention of the epithelial *débris* in the sac and duct, and it is usually necessary to pass a probe once through the duct down to the nose to make the passage fully patent. One probing is, in the large majority of instances, enough to cure.

In adult life blocking of the nasal duct is much less common in men than in women; it begins as a congestion of the muco-periosteum, and in this stage may often be cured by the application of astringent antiseptics to the sac walls. It is necessary, as a preliminary step, to dilate the punctum; then the nozzle of a lacrymal syringe is passed into the sac, the syringe, filled with the selected solution, is attached to the nozzle, and the sac washed freely out. One of the proteid salts of silver is an excellent application for the inflamed walls. I usually make use of argyrol in weak solution (2 to 5 per cent.). Care must be taken to squeeze out as much as possible of the solution after the sac has been washed through. If it is left in the sac, the walls and perhaps eventually the overlying skin may show discoloration from argyrosis.

Zinc chloride ($\frac{1}{2}$ gr. to the ounce) may be substituted for the silver salt, if preferred. After washing out daily for some time it will usually be found that fluid begins to pass through to the nose. Gradually the passage becomes freer, and eventually the cure may be complete. This can only be expected if the disease is recent; when the blockage is old, the muco-periosteum has usually laid down new bone and converted the congestive into a bony stricture.

In this stage the sac is often largely dilated and contains a thick mucoid fluid, from which it gets the name of mucocele. Often the contents become purulent; then the septic inflammation may be communicated to the soft parts around the sac and an abscess is formed which may or may not open freely into the sac.

Such a condition is a source of grave danger to the eye; the smallest abrasion of the cornea may, and not improbably will, become infected by the swarming micro-organisms, and the whole eye may be lost.

It is most important, therefore, to remove the danger, and this may be attempted in one of two ways. We may, and in most cases should, attempt to re-open the passages by douching, and when this has failed, by the passage of probes. There are two methods of dilatation, the *gradual*, in which the size of the probes is gradually increased and the passage is restored after many probings to its normal, and the *immediate*, in which, after anæsthesia, the passage is forced to receive the largest-sized probes. The latter method is likely to be attended by traumatism to the bone and to the mucous membrane. The former should be adopted when possible. When the duct, in either case, has been restored to its full calibre, it is often necessary to make the patient wear a lead or silver style to keep the duct free; such a style may be worn without difficulty for a long time.

The manœuvre of passing a probe is executed as follows: The canaliculus must be divided; in England the lower is usually chosen; the upper has been recommended, inasmuch as it leaves the lower, which is the more important in the normal removal of tears, unaltered. A medium-sized Bowman's probe is taken and passed horizontally into the canaliculus until the end is felt to touch the lacrymal bone; the probe is then brought into the vertical position, while slight pressure is kept up against the bone, and the end of the probe will slip down into the upper end of the duct. Pressure is then made in the direction of the duct, *i.e.*, downwards, backwards and a little outwards, until the probe passes the stricture. Should it happen, and it is by no means a rare occurrence, that the passage recontracts in spite of all we can do, or that the probing cannot be borne, there remains the possibility of removing the danger by obliterating the passages entirely. The lacrymal sac is dissected out through an incision carried down over it through the tendo oculi.

Contrary to what might have been expected, the epiphora following the excision is in most cases slight, and when it is greater, examination will often show that the excision has been incomplete and that a small diverticulum of the sac has been left in connection with one or other canaliculus. The excessive secretion of tears is due to the constant irritation of the conjunctiva by the purulent contents of the sac, which are always regurgitating in some quantity through the puncta.

HAROLD B. GRIMSDALE.

DISEASES AND AFFECTIONS OF THE EYELIDS.

Blepharitis.—This very chronic affection (known also as sycosis, tinea tarsi, etc.) is much more common among the children of the poor than of the well-to-do. It is probable, therefore, that it arises from want of care and cleanliness in looking after the children's eyes. It is a common complication of chronic inflammations of the conjunctiva, and is apparently due to infection of the hair follicles.

It is seen in two forms; one, the more severe, is associated with eczematous ulceration of the lid margin, the other is non-ulcerative; there is no real difference, and the distinction is merely a clinical one. Since the disease is deep in the hair follicles, which are closely blocked at the mouth by secretion, it is somewhat difficult to deal with. It is useless to smear ointments on the surface; the mouths of the follicles must be freed from the crusts which block them and the selected drug rubbed down into the depths before the secretion has re-accumulated at the entrance. Further, the inflammatory condition of the conjunctiva must be removed or the follicles will be re-infected at every moment. Often the slight hyperæmia is the result of some error of refraction, and the accurate correction of any such error is an important part of the treatment.

It is usual to use an alkaline lotion to loosen the crusts from the lid margin; sodium bicarbonate (5 gr. to the ounce of warm water) makes a very useful application; when the crusts and scales have all been softened and removed we must rub into the hair follicles without delay an astringent antiseptic ointment, for which the yellow oxide of mercury ointment is probably best: ℞. Hydrargyri Oxidi Flavi, gr. 2; Paraffin. Moll., Adip. Lanæ Hydrosi, āā gr. 60. The lanoline is easily absorbed by the skin, but if used alone is rather stiff.

Some surgeons add to this ointment ichthyol (1½ gr.). Casey Wood prefers a special "brown ointment," which is similar to the B.P. dilute citrine ointment, but with the substitution of cod-liver oil for the neat's-foot oil. "When thoroughly mixed, it should be exposed to the air in a protected jar for at least three weeks, being stirred every day until the yellowish-white-brown ointment turns almost black-brown. In the course of a month after preparation mercuric iodide (or a still more complex organic compound) is formed which joins with some constituent of the oil" to form "a smooth, oily seal-brown mixture of the consistence of molasses." This he dilutes, if required, with fresh cod-liver oil. It is applied with massage; the rubbing prevents the pain and smarting which follow the simple application. Care must be taken that none reaches the clothing, as it makes an almost indelible stain. Since the disease is very often secondary to the conjunctivitis due to the Morax-Axenfeld bacillus, some surgeons treat the lid condition with zinc; this has not seemed to me to give as good results as the mercury.

There is little doubt that the case is benefited and the course shortened if a solution of protargol (10 per cent.) is thoroughly rubbed into the lid margins by the surgeon, as a preliminary measure, two or three times a week for a month. This application was first advised by Darier.[1] He dips a mop of wool into the solution of protargol and makes a lather along the roots of the lashes as with a shaving brush.

This "protargolage" gives rise to no pain or discomfort. Between the applications the treatment by the alkaline lotion and astringent ointment must be steadily persevered with. Improvement is speedy, but the superficial improvement does not mean cure; unfortunately the parents rarely take the necessary trouble; as soon as the lids are free from crust and redness they discontinue the treatment, and the disease, which is lurking in the depths of the follicles, reappears.

To complete a cure treatment must be continued for months after the cure is apparent.

In chronic cases which resist all other means treatment by a vaccine will sometimes give good results.

An appearance somewhat similar to blepharitis is occasioned by the presence of pediculi (P. pubis) and their eggs among and on the eyelashes. Careful examination will at once clear up the diagnosis. The ova and adult parasites should be removed as completely as possible by forceps and a mercurial ointment rubbed into the hair region. Relief is immediate.

Chalazia.—These are tumours of the Meibomian glands; in the first stage they occasion pain and swelling, and may be mistaken for styes; the position, away from the lid margin, will soon determine the diagnosis.

Chalazia rarely suppurate immediately; the tumour settles down into a hard rounded lump which is unirritating.

Sometimes in the early stages it may be possible to bring about resolution by massage with yellow oxide of mercury ointment.

Often surgical interference is required. The cyst should be incised by a vertical incision from its conjunctival surface and the contents scraped out by a sharp spoon; this can be done without a general anæsthetic, but it is much more comfortable for the patient to have one.

It is sometimes recommended to eviscerate the tumours by incision in the grey line; this seems to have no advantage, except in the case of those very close to the lid margin.

Hordeola.—A stye is a boil in relation to an eyelash follicle. It is in most instances due to a staphylococcus infection, and is apt to be seen in crops as one follicle after another is infected. Treatment must therefore be directed not only to the individual present stye, but also to the future; it is possible sometimes to abort the stye in an early stage by pulling out the hair and touching the hair follicle with pure carbolic on the end of a pointed piece of wood pushed down into the mouth of the follicle. Usually this is not practicable. When the swelling is great hot fomentations with antiseptic solution will relieve it and the pain. If the stye points the pus may be evacuated by a small incision. Secondary infection must be guarded against by the use of the yellow oxide of mercury ointment, and frequent bathing with perchloride lotion (1 in 4,000) or sublamine (1 in 2,000).

The recurrence is often associated with general disturbance of health; calcium sulphide ($\frac{1}{2}$ gr.) in form of a pill may be given two or three times a day. Sometimes, if the patient is anæmic, iron will put a stop to the condition. Usually I find the local measures indicated above are sufficient. Staphylococcus vaccine is often useful in those obstinate cases; a dose of 5 millions may be followed a week later by a dose of 10 million cocci. This may, if preferred, be given by the mouth. (*See* Vaccine Therapy.)

Ptosis.—Ptosis occurs in several forms; it may be congenital, as the result of weakness or imperfect development of the levator palpebræ muscle, it may be the result of long-continued spasm of the orbicularis, or it may be acquired as the result of paralysis. Its treatment, in most of the varieties, is chiefly surgical. When occasioned by paralysis of the levator we may attempt to restore the action by medical treatment, and in such cases as the late syphilitic we may be successful; in congenital deformity, on the other hand, it is necessary to operate, and the surgeon will have a choice of methods.

If the levator is merely weak, he may improve its capability by altering its attachment to the tarsus; if this is insufficient he may call in the aid of one or other of the accessory elevators of the lid, the frontalis or the superior rectus, and alter their relations to the lid. The frontalis may be joined to the lid by an artificial tendon of gold wire, as in Mules' method, by a skin flap, as in Panas' operation, or the whole lid may be lifted up to the frontalis, as is done by Hess. On the other hand, the superior rectus may be attached to the lid (Motais' operation); in this case the relation of movement which exists normally between the eye and the lid is restored. But the operation has certain special risks, which will probably prevent its general adoption; in a few cases where acquired ptosis from paralysis has persisted so long that recovery is out of the question a good result may be obtained by attaching the tendon of the atrophic levator to the frontalis (*see also* p. 650).

Trichiasis and Entropion.—When the lashes brush against the cornea the condition is called trichiasis; when the whole border of the lid is inturned, entropion. Both these conditions are the result of scarring or spasm of the orbicularis muscle. Sometimes there are found, as a congenital malformation, two rows of well-formed eyelashes; the posterior row, which is directed backwards, seems to take the place of the Meibomian glands (districhiasis).

The milder cicatricial form, trichiasis, often follows old-standing blepharitis; the lashes then are thin and weak and their maldirection depends on slight cicatricial contraction round the mouths of their follicles; when a few only of the lashes are inturned, they may be pulled out from time to time as they become troublesome.

When more are inverted, there must be surgical interference, not only on account of the discomfort, but also largely on account of the risk of infection from the micro-organisms with which the lashes are laden. The best form of operation for old blepharitis is some form of Van Millingen's; in this an incision is made in the "grey line" (the intermarginal space) and the gap, formed by pushing the lashes away, filled by a graft of mucous membrane from the mouth.

When the entropion depends on cicatricial alterations in the tarsal plate, a cure can be brought about only by altering the curvature of this plate; and to effect this, the method of Streatfield or Snellen is probably the best. This consists in laying bare the anterior surface of the tarsus and excising a prismatic strip at the region of greatest curvature in the whole length of the lid.

Other surgeons incise the cartilage from the posterior surface and by tension on its anterior surface fix it in a position which corrects the entropion. This method has the disadvantage that it lays the areolar planes of the lid open to invasion of micro-organisms from the diseased conjunctiva.

Many surgeons, and some who have a very large experience of the condition, say that it is unnecessary to attack the tarsus, and rely entirely on Van Millingen's operation.

A form of entropion of the lower lid from spasm of the orbicularis occurs not uncommonly in old people. It is frequently troublesome when such patients require bandaging after operation. The deformity can always be corrected temporarily by pulling the lid down with the finger, but if the bandage has to be replaced the entropion returns very shortly. Sometimes the careful application of contractile collodion to the affected lid will hold the parts in good position as long as is needful; care must be taken in applying this that none enters the eye; the ether would occasion a sharp attack of inflammation. Sometimes the lid may be held down with a small strip of plaster.

Usually these simple measures are insufficient, and then it becomes necessary to fix the lid more permanently. This may be done by means of "Gaillard's sutures." A suture, armed at each end with a needle, is taken; one needle penetrates the skin near the lashes and travels downwards, grazing the tarsal plate, to the lowest fold of the lid. The other needle takes a similar course parallel with the first and about 6 millimètres away; one such suture is passed at each extremity of the middle third of the lid; they are tied fairly tightly over a piece of drainage tube or roll of gauze. The tension on the skin holds the lashes everted.

If the deformity returns it may be advisable to excise an oval, lanceolate area of skin and the underlying muscle. The wound is then closed, the stitches being passed through the skin and through the lower part of the orbicularis.

Ectropion.—Eversion of the lid is due to several causes: (1) To cicatricial contraction of the neighbouring skin; (2) to paralysis of the orbicularis muscle; or (3) to hypertrophy or other pathological swelling of the conjunctiva.

The treatment of the first form is purely surgical, and each case must be dealt with on its merits by sliding skin from the neighbourhood, by flaps from the surrounding parts, or by grafts taken from a distance. Many of these cases are most difficult to deal with.

The second form, due to paralysis, may be treated by attempts to restore the nerve. Recovery is sometimes complete, but more commonly, perhaps, is only partial. Some small operation to assist the closure of the lids (such as canthorrhaphy) may be undertaken.

The third cause, hypertrophy of the conjunctiva, is often associated in old people with some loss of tone of the orbicularis. The whole lid is lengthened and must be shortened as well as lifted up. Occasionally in the early stages astringents will improve matters, but most commonly it is necessary to excise the hypertrophied section of the conjunctiva, and often in addition to shorten the lid.

The lids are frequently the seat of **rodent ulcer**; this demands surgical interference or removal by means of radium.

Near the inner canthus there are often seen yellowish raised patches of **xanthelasma**; these, if very unsightly, may be excised; no therapeutic measures are of avail.

HAROLD B. GRIMSDALE.

REFERENCE.

[1] Darier, "Leçons de Therapeutique Oculaire."

DISEASES AND AFFECTIONS OF THE IRIS AND CILIARY BODY.

THE iris and ciliary body being contiguous structures, associated in function, are commonly affected together in disease. As a result, the treatment required for affections of the one is very largely that needed for the other. At the same time, a special train of symptoms indicative of the preponderance of the trouble in one or other structure is nearly always manifest, so that the disease is termed irido-cyclitic or cyclo-iritic in nature, according as the iris or ciliary body is the structure prominently affected.

Thus in the succeeding remarks the treatment detailed for affections of the iris may be considered to hold good for similar affections of the ciliary body, except in the case of certain symptoms peculiar to one or other structure, which will receive a separate consideration.

ACUTE IRITIS.

It will be best to consider first the general lines of treatment suitable for all varieties of acute inflammation, and then to present, in separate sections, the special details suggested by the causative factor of the inflammation.

General Treatment.—*Mydriatics.*—The first imperative consideration is the early and speedy dilatation of the pupil. At the very commencement of an attack of iritis the pupil begins to contract, exhibiting, in the first instance, an unwonted sluggishness in response to the usual stimuli, and then, getting smaller as the iris tissue becomes distended with inflammatory products, it may eventually become no larger than a pin's head. The dangers of a contracted pupil in iritic inflammations are manifold, and are to some extent proportionate to the contraction. Exudation from the iris will speedily seal the iris down to the lens capsule by bands, which, in a remarkably short time, become unbreakable, and lymph deposited on the face of the pupil will quickly cause irreparable damage to the sight by forming a permanent opaque film. The smaller the pupil, the quicker will vision be thus impaired, and the quicker, too, will it be bound down by inflammatory bands, or "posterior synechiæ" as they are termed. The greatest danger lies in the production of a secondary glaucoma, set up by the excluded pupil preventing the passage of fluids from the posterior to the anterior chamber, a condition which, once initiated, can only be checked by operative interference. Thus it becomes of the first importance for the integrity of the eye to use mydriatics as speedily as possible, whilst, from a curative point of view, their use is scarcely less valuable. The dilatation of the pupil helps to relieve stasis and congestion by forcing the iris into its narrowest dimensions. At the same time it relieves the severe pain caused by the congestion and tension, and so improves the physical and mental condition of the patient.

The best mydriatic at our disposal is *atropine*, and if used consistently and sensibly at the commencement of the trouble, it will, in the vast majority of cases, prevent any serious damage to the eye resulting from an attack of iritis. It should at first be employed either as a 1 per cent. solution of atropine sulphate in the form of drops, or the alkaloid of a similar strength can be made up with vaseline, and employed as an ointment placed within the lids. The advantage which an ointment possesses over drops is that the atropine is held longer in contact with the eye, and less easily filters through the lacrymal canal. On the latter account the ointment is much less liable to set up toxic symptoms than the drops, but it has the disadvantage of sometimes causing a severe weeping eczema of the lids, known technically as "Atropine Irritation." Should this occur, or in the event of atropine drops causing toxæmia, atropine must be given up and some other mydriatic substituted. The best alternative is undoubtedly hyoscine, which, however, must not be used in such large doses as atropine, and the effects of which must also be carefully watched. As a rule there will be seldom any trouble with atropine unless the patient has a belladonna idiosyncrasy, and provided that care is taken in the case of the drops to use one drop only at each application, and when employing atropine ointment to put only a small quantity between the lids, so that it does not ooze on to the eyelids and cheek and remain in contact with the skin.

The atropine should be applied every three hours when the patient is first seen until the pupil is widely dilated, and when this has been effected, the frequency should be gradually lessened so as to find out the minimum dose required to keep it so. If the patient is seen early in the attack before adhesions are formed, or before they are strong, a speedy dilatation may be hoped for, but if the surgeon is not so lucky, as will often be the case, then a stronger dosage of atropine may be advisable, or the atropine may be combined with *cocaine*. The combination of atropine and cocaine is a very good one, and is undoubtedly of greater power than atropine alone. The strength of the cocaine should be twice that of the atropine, and the combined drugs should be used in the same way as atropine alone. If the pupil steadily refuses to show any marked response after twelve hours' trial with a 1 per cent. preparation of atropine or atropine and cocaine, then a 2 per cent. strength of atropine should be tried, and continued cautiously until the desired effect is produced, when resort should be had once more to the weaker preparation. It is not wise to use a strength greater than this, and it is very doubtful if any bands sufficiently firm to resist the action of a 2 per cent. solution of atropine, combined with a 4 per cent. solution of cocaine, would be broken down by any mydriatic, but it may be borne in mind that synechiæ may resist the mydriatic for days and yet suddenly and unexpectedly yield. This being so, one must not be discouraged by the apparent failure of the mydriatic in the first instance, but must steadily persevere; only, as adhesions are quickly formed and quickly become organised, it behoves one to have early recourse to the strongest preparations consistent with safety to the patient if the pupil does not quickly respond to the weaker ones. In every case the pupil should be kept fully dilated, not only whilst there are any signs of inflammation, but for some time longer, as all forms of iritis have a tendency to relapse, and when it is considered safe to allow the pupil to assume its normal dimensions, the patient should still be kept under observation for a time.

Heat.—As in other varieties of acute inflammation, heat is of the greatest value. There are two excellent methods of applying heat to the eye: (1) Hot bathing, and (2) Dry heat.

Hot bathing is very efficiently carried out by taking a handful of absorbent wool, wrapping it in a clean towel, and dipping the latter in a jug of boiling water or boiling decoction of poppy-heads. The ends of the towel should be left hanging out of the jug, so that the wool can be well wrung through the towel, after which the damp steaming mass is applied to the closed lids. Whilst this is being done, an attendant prepares a second similar hot pad, which takes the place of the first as soon as the latter begins to cool, and in this way the eye can be steamed continuously for about twenty minutes. A dry piece of wool should then be placed over the eye, supported by a silk handkerchief or bandage, and the eye kept tightly covered for an hour so that cooling may be gradual. This hot-bathing or steaming can be carried out every four hours during the day so long as the inflammation is acute, and generally gives much relief.

Dry heat is often more efficacious than the method just described, and is a favourite treatment at Moorfields Hospital. It is applied in the following way: A small Japanese muff-warmer is filled with two charcoal cartridges, the opposite ends of which are lighted, and it is then placed between two large pads of gamgee tissue. The muff-warmer thus encased is laid on the patient's face so as to well cover the inflamed eye, and is kept in position by a few turns of bandage. The patient lies on a couch or bed, and the cartridges are allowed to smoulder until consumed. The only difficulty is that the cartridges will not keep alight unless there is plenty of ventilation, and some little experience and management is required to make them burn well; but once this little trouble is overcome, a magnificent heat is generated which will last continuously for about one and a-half hours. The muff-warmer is very light, and rarely, if ever, does the weight cause inconvenience, and this method can be carried out twice daily if thought desirable.

Leeches.—When pain is very severe and the congestion great, there is nothing that gives so much ease as leeching. To obtain the best results the leech should be applied as near to the outer orbital margin as possible. Two or three leeches can be applied at once, or one leech may be applied daily so long as is considered necessary. It is a wise precaution to put the leech into clean water for an hour or two, and to have the water changed once or twice before the leech is used.

Blisters.—Small blisters, about the size of a shilling, applied to the temple in the neighbourhood of the eye, are often of great service in the more chronic stages of the disease. They can be ordered two or three times weekly in different spots, and we think this method is rather better than putting one large blister on the temple, which prevents any further blistering for at least ten days.

Lotions, etc.—During the acute stages the patient is generally most comfortable if the eye is kept closed, and for this purpose a pad of lint or gamgee tissue soaked in a boracic lotion and covered with a piece of oiled silk or jaconet, surmounted by a light bandage, is usually preferable to a dry dressing. The eye may also be bathed three or four times daily with a tepid boracic lotion, or if boracic irritates, as is sometimes the case, a weak alkaline lotion of bicarbonate of soda (gr. 7 ad ℥j) is equally as good and refreshing. When the patient is convalescing smoked protecting glasses fitted with gauze sides should replace the pad and bandage, and should be worn continuously so long as any photophobia is present. They should also be worn out-of-doors for the first week or two that this liberty is permitted, as a precaution against relapse.

Dionin has been highly extolled by some writers as a sedative, and a very useful drug in acute iritis; but in our experience, which is considerable, it is anything but satisfactory during the acute stages of inflammation. It is then much more likely to irritate than to soothe, and is best avoided; but when convalescence is setting in it is often of great value if used judiciously. It is best given in the form of drops, which may conveniently be added to the atropine, and a solution not stronger than 2 to 3 per cent. should first be tried. If this is borne well, the strength of the drops may be increased to 5 per cent. and then to 7 per cent., which is usually sufficiently powerful. The drug quickly loses its effect, and hence the need for gradually increasing the dosage; but when the last-named strength has been given for a few days it is a good plan to discontinue it altogether for a while, after which it may be used once more with fresh effect.

Internal Treatment.—This must largely depend on the determining cause of the inflammation, and will be further discussed in succeeding paragraphs, but in all cases whatever the cause a routine of light, non-stimulating diet and treatment to keep the digestive functions working smoothly is to be employed. Mercurials are especially valuable in old subjects for this latter purpose, and alcohol is as a rule to be avoided.

SPECIAL VARIETIES OF IRITIS.

Rheumatic Iritis.—This class embraces a very large proportion of all cases of iritis. It includes those due to idiopathic rheumatism, gonorrhœal rheumatism, gout, and a large number of cases of indefinite origin often associated with some toxæmia resulting from impaired or ill-performed digestive functions. It is this latter class which furnishes the greatest difficulty in treatment. When there are clear indications of a rheumatic or gouty diathesis, the adoption of the usual remedies, such as salicylates, aspirin, iodides and so forth, will usually meet with success, but there often arise cases in which history throws no light upon the cause, and which often enough occur in apparently perfectly healthy young adults without any obvious ailment. In such cases a thoroughly exhaustive examination should be carried out, and in not a few the causal origin will be found in bad teeth, chronic dyspepsia, constipation, or some intestinal derangement. In women, inquiry must also be made as to menstruation, and with regard to the ovarian and uterine condition generally. In short, nothing must be left unexamined, for successful treatment largely depends upon the suppression of the cause. A single attack of iritis may not leave any trace of its presence, but repeated attacks must eventually damage and may destroy sight, and in that the nature of this inflammation is to recur, we must emphasise once again the importance of ascertaining the cause and treating that.

Special mention must be made of cases associated with gonorrhœal rheumatism. Lately, gonococcus vaccines have been used with success, and there can be no doubt that vaccine treatment is now the course to adopt. It does not seem to be necessary for the vaccine to be made from the patient, which is a lengthy and difficult proceeding, and at Moorfields we use a vaccine composed of three or four strains of gonococci. It is really necessary to add that vaccine treatment should *not* be carried out by any but an expert in these matters.

There is one very prominent symptom associated with all cases of rheumatic iritis, and that is *pain*, which in definitely rheumatic and gouty patients is always much worse at night. Sleep is essential for repair, and unless there is some contra-indication, opium or morphia should be prescribed freely during the acute stages of the disease. Bromides, chloral, veronal and such drugs are useless in iritis, and nothing can take the place of opium and morphia.

Syphilitic Iritis.—In whatever stage of syphilis iritis may appear, whether as a late secondary manifestation or as gummatous nodules deposited in the iris, energetic mercurial treatment is indicated. The mercury may be combined with iodides if preferred, but the latter should not take the place of mercury. The method by which mercury is given must rest with the surgeon; personally we prefer inunction by a masseur specially skilled in this work, but in hospitals the internal administration is the more usual as being the more easily managed, and this can be combined with some inunction if considered desirable. It seems probable that treatment by Ehrlich's salvarsan (606) will in the near future supplant all other remedies in syphilis; but though the results are extraordinarily brilliant in syphilitic iritis, it is too early as yet to make positive statements as to the lasting power of this treatment.

Syphilitic iritis is especially distinguished by the slight severity of subjective symptoms as compared with the rheumatic class of case and by its tendency quickly to cause large dense adhesions of the iris to the lens capsule. It is, therefore, most essential in these cases to get the iris under the influence of a mydriatic at the earliest possible moment, and unfortunately a satisfactory dilatation cannot always be procured in bad cases, even if this point has been fully recognised, and atropine in full doses employed from the commencement of symptoms. The absence of severe pain, too, may also mislead the patient, who often does not seek advice until hopelessly dense adhesions are formed.

Tuberculous Iritis.—The treatment of this form of iritis is far from satisfactory. The disease may limit itself to the iris and ciliary body, and we have had brilliant results in some cases from prolonged treatment with tuberculin combined with special attention to the general health after the usual methods, and, of course, local treatment to the eye. On the other hand, the iritic manifestation is often only a symptom of a general infection of the uveal tract, and such cases do badly whatever treatment is adopted. The inflammation is always of the quiet kind, unaccompanied by much pain or photophobia, and under the best of circumstances tends to drag on indefinitely. Those cases that do well require constant care for many months, and sometimes the patient may be incapacitated for two or three years, eventually getting a good restoration of sight. In unfavourable cases the eye slowly degenerates until vision is destroyed, although the patient may continue in apparently good health throughout. When vision is destroyed our own feeling is that the eye should always be removed. It is undoubtedly a source of possible infection, and we have seen the disease spread to the second eye many months after complete destruction of the first had taken place. Tuberculous meningitis is also a not infrequent termination in children, and it is possible that in some such cases this may result as a direct infection from the eye.

Traumatic Iritis. (*See* Injuries of the Iris, p. 591).

RECURRENT IRITIS.

When in spite of careful treatment the pupil is becoming fastened down to the lens capsule or is occluded by organised lymph which has greatly marred the sight, the proper treatment is to perform an *iridectomy*, which will open up a free passage for nutritional fluids, and, when the pupil is densely occluded, will considerably improve the vision.

The operation has also been advanced in less severe cases as a preventive to fresh recurrences of inflammation, and under this guise has been and often is performed by unscrupulous surgeons for mercantile reasons. Let it be said at once that iridectomy as a preventive of iritis is of no use except in cases where the *nutrition* of the eye is threatened or impaired by adhesions, and it should only be performed when such is the case.

Although operation should be delayed until this state of affairs, it is also important that it should not be unduly delayed. The iris stroma is very apt to undergo atrophy from repeated inflammation, and the adhesions to get very broad and dense, so that it may become impossible to secure a satisfactory coloboma; or the attempt to do so may cause a tear in the lens capsule and induce cataract.

The operation should never be performed except when the eye is quite quiet and has been so for a considerable time, for there is always a risk of setting up a traumatic iritis by the operation, which would probably seal down the edges of the coloboma, and greatly mar, if not destroy, the beneficial result. In most cases all that is required by operation is to open up a channel for the passage of the nutritional fluids, and consequently a large or peripheral coloboma is best avoided for optical reasons. At the same time, if we have reason to think that the angle of the anterior chamber is actually shut off by adhesion of the root of the iris to the cornea, as sometimes happens in long-standing cases of iris bombé, or blocked by organised lymph, the iridectomy should be peripheral and performed as for the relief of glaucoma.

The iridectomy should, as a rule, be placed upwards, so that the upper lid may to some extent cover the coloboma and limit diffusion, but the use of atropine may show that the pupil is particularly bound down in this situation, in which case some other site should be selected.

It sometimes happens that a patient is seen with an excluded pupil and iris bombé suffering from an acute attack of inflammation accompanied by great increase of the intra-ocular tension. It is not wise to do an iridectomy with the eye acutely inflamed as explained above, and if the high tension persists in spite of leeches, fomentations, etc., and threatens to destroy the sight, the right treatment is an *iris puncture*. To do this a narrow Græfe knife is entered at the corneal limbus and is passed through the bulging iris, puncturing it freely. In this way the tension is relieved for the time being, and the usual remedies to subdue the inflammation will probably be successful. The opening will very likely close up again in a few days, and if necessary, the puncture can then be repeated. When the eye is quiet an iridectomy can then be done with comparative safety. There is no danger of wounding the lens when puncturing the iris if the knife is held so as to keep close to the back of the iris, because the latter is bulged away from the lens and is separated from it by a considerable interval, except at the pupillary margin where the two are in contact.

In cases where the iris is adherent to the lens capsule throughou its breadth (total posterior synechia) an iridectomy is impossible, and the best method of relieving abnormally high tension is to do a trephining operation after the method of Fergus or Elliot, or to perform a sclerotomy in the way designed by Herbert (*see* Glaucoma).

INJURIES OF THE IRIS.

The iris may be torn from its attachment to the ciliary body (iridodialysis), or the sphincter may be lacerated or ruptured or any part of the iris injured by penetration with a foreign body or instrument. In all these various injuries the main treatment is rest, together with atropine to counteract any iritis that may result. If a foreign body is entangled in the iris, an opening in the anterior chamber should be made for its extraction, which will frequently necessitate the removal of a piece of the iris at the same time. If the foreign body is magnetisable, there is a good chance of removing it without an iridectomy by applying the hand-magnet or Haab's large magnet direct to the cornea before an incision is made. The foreign body may then liberate itself and lie free in the chamber, whence it is easily removed through a small corneal incision; but if the aqueous has been let out the iris will follow the movements of the entangled foreign body, and a removal of the two together will almost certainly be necessary. Should a traumatic iritis follow an injury, the treatment detailed above for acute inflammation of the iris should be followed.

Prolapse of the iris through a perforating wound of the cornea is a serious injury which demands immediate treatment. No attempt to push back or replace the protruding portion should be made. In the first place, any attempt would fail; and secondly, very serious bruising would result which might cause a destructive inflammation of the whole structure.

If the accident is treated within a few hours of its occurrence, all that is necessary is to take hold of the prolapse with iris forceps, pull it well out so as to expose all that has been caught in the lips of the wound, and then cut it off as close to the wound as possible. If this has been well done the iris will now slip back away from the wound, which is entirely freed. After this a drop of eserine or atropine, whichever may be indicated to draw the iris away from the wound, is instilled and the eye tied up. It is not wise, however, to use eserine for long for fear of adhesions forming to the lens capsule, and, further, there will be no advantage in employing it after the wound has been closed for a few hours.

If the case is not seen for a day or two after the accident, it will be necessary to disengage the entangled iris from the wound before attempting to abscise the prolapsed portion. This is done by gently inserting a fine silver spatula between the iris and each lip of the wound, using a gentle traction on the iris whilst doing so. Unless this is successfully accomplished the iris will remain adherent to the base of the wound at some part after abscission of the prolapse, and a very chronic and troublesome iritis, often involving an ugly displacement of the pupil, is apt to follow.

TUMOURS OF THE IRIS.

These are all rare. Cystic growths of various kinds are sometimes amenable to removal by excising the involved portion of the iris. Primary malignant tumours should only be treated by removal of the globe, unless the growth chance to be a very small sacoma affecting only a portion of the iris so that it can be removed freely by an iridectomy. Malignant tumours secondarily involving the iris are, of course, unamenable to any treatment but enucleation of the eye.

INFLAMMATION OF THE CILIARY BODY (CYCLITIS).

The ciliary body is necessarily involved in a very large proportion of cases of iritic inflammation, and no special treatment beyond that detailed already for iritis is required. When the inflammation commences primarily in the ciliary body and thence spreads to the iris, the same remark holds good; but cyclitis often produces a special train of symptoms, the treatment of which will be now considered. One of the most frequent complications of cyclitis is an inflammation of the ciliary glands resulting in a great outpouring of aqueous humour. When this occurs the anterior chamber is much deepened, and the intra-ocular tension may be increased to a dangerous degree. Apart from any consideration as to the presence or otherwise of iritis, atropine is very useful, not only because it dilates the pupil and places the iris out of danger, so to speak, but also because it is a cycloplegic and acts directly on the ciliary body, which is also put at rest so far as can be effected. Full doses of atropine should therefore be employed in cyclitis so as to get the maximum cycloplegic effect. We should not be deterred from the use of atropine because the intra-ocular tension is somewhat increased. The dilatation of the pupil will not increase this tension, for the chamber is abnormally deep and the angle of the anterior chamber is abnormally distended. On the contrary, if we can only get the atropine to act well so that the pupil becomes widely distended, the tension will often come down to normal from the relief given by resting the inflamed part. However, when the intra-ocular tension is very high atropine will have no effect, and then we must have recourse to other means to lower the tension, and the best at our disposal is to puncture the cornea and to let out the aqueous. This little operation can be repeated as often as required if done with care, but it has its dangers, and a few words as to the technique are necessary.

Paracentesis of the Anterior Chamber.—The instruments required are: (1) Speculum; (2) fixation forceps; (3) broad, lance-shaped cutting-needle. The eye is cocainised and the patient recumbent. The puncture may be made anywhere just within the corneal limbus. Fixing the eye close to the limbus opposite the site chosen for puncture, the surgeon makes an oblique incision through the cornea with the broad needle, and as soon as the point is seen to be well in the anterior chamber, he depresses the handle so as to elevate the point and slowly withdraws the needle, letting out the aqueous as he does so.

The following are the special points requiring attention:

(1) A large incision is not required. The larger the incision the more difficult it is to control the escape of aqueous.

(2) The needle should not be passed far into the anterior chamber. There is always a slight risk of the patient moving suddenly and the aqueous from this or some other cause escaping with a rush, in which case if the needle was largely in the chamber it might wound the lens before it could be withdrawn.

(3) The aqueous should be let out very slowly. This can be easily managed by the use of the lance needle, which can be employed as a plug, thrusting it into the wound if the aqueous pours out too quickly. A rectangular knife could not, of course, do this. If the aqueous rushes out, great pain will be caused to the patient, who will probably wince violently and endanger the eye, and also when the tension is very high its sudden release is very apt to cause hæmorrhage from the iris or deeper structures.

Some writers have advocated the performance of an iridectomy to relieve tension, but it is only in exceptionally chronic and persistent cases that it is of any use, when repeated paracenteses and other measures fail to permanently relieve, and when we have reason to believe that the anterior angle, dilated though it be, is blocked by organised exudate.

Vitreous Opacities.—A frequent complication of cyclitis is the spreading backwards of the process, with the involvement of the vitreous humour. This is a most serious consequence of cylcitis, because changes in the vitreous may cause so much damage to the sight and are so intractable. The vitreous may become entirely liquefied and so filled with dusty or bees'-wing opacities that the fundus cannot be discerned. In such bad cases the eye is often eventually lost by progressive destructive changes, ending finally in phthisis bulbi or shrinkage of the globe. The treatment demanded by the appearance of vitreous changes is prolonged rest to the eyes, even though the outward manifestations of inflammation have subsided. It is not an easy matter to persuade a patient to take a complete rest from close work for six months or a year, especially if a cure cannot be guaranteed, but therein lies the best chance of the vitreous clearing up. In many cases of not too severe a nature this simple treatment will be followed in course of time by steady improvement, and the sight may often be practically restored to normal, provided no fresh attack of inflammation occurs and that a good general health of the body is maintained. Throughout the treatment the eyes should be kept under the influence of atropine, employed just as often and in just such a dose as is required to maintain its cycloplegic power. Tinted glasses should be worn in bright glares and also as a protection from wind. Climate, diet and the general surroundings of the patient should have attention, and everything done to combat the depressing mental effect that prolonged inability to use the eyes is always apt to produce.

Dionin seems sometimes to have a markedly beneficial effect, though it is uncertain. It should be tried much as recommended in the treatment of iritis. The method we adopt is to employ it for a month, commencing with a 2 per cent. solution for the first week, increasing to 4 per cent. the second week, 6 per cent. the third week, and 8 per cent. the fourth week. It is then entirely discontinued for a month, after which a fresh month's course may be given.

The internal administration of drugs is not of much value, with the exception of the iodides of sodium or potassium, which are always worth trying, and may be pushed if the patient can stand this treatment well. In cases of syphilitic origin they are, of course, especially indicated. Some prefer the organic preparations of iodine, such as iodo-glidine or tiodine, but we cannot say that we have found any especial advantage in their use.

Tonics of iron and arsenic and strychnine may be useful, and employed either as an alternative to the iodides or to follow a course of the latter.

In every case, however, the main local treatment is rest, and prolonged rest. In spite of the greatest patience and willingness on the part of the sufferer, not a few cases fail to improve or continue to slowly deteriorate, but anyhow, by following out a long-continued treatment on the lines given, we have done the best that can be done to restore the sight.

No special treatment for syphilitic or tuberculous cyclitis beyond that already detailed in dealing with iritis due to these causes need be mentioned.

TRAUMATIC CYCLITIS.

Wounds involving the ciliary body still give rise to peculiar apprehension. There is no doubt that in spite of the complete present-day knowledge of dealing with wounds of all kinds that injuries, and especially lacerations of the ciliary body, are, above all others, liable to be followed by sympathetic ophthalmitis.

We must be guided in our treatment by the particular circumstances surrounding each case. If it is a wound of so grave a character that the sight is destroyed or the eye rendered practically useless, there can be no doubt that the sensible and wisest plan is to enucleate early. So, too, if the wound is torn and jagged, with much laceration involving a large extent of surface, the same advice should be given, even if some sight is left, provided that the other eye is visually good. On the other hand, if it is a clean-cut wound stretching back from the cornea into the ciliary region without excessive damage to sight, an attempt may be made to save the eye, especially if we have reason to think that the agent of the wound was fairly clean. If the vitreous presents, it should be snipped off close to the wound and the edges of the latter united by a silkworm-gut suture.

In closing a scleral wound with a suture, care should be taken not to involve any uvea in the lips. Any prolapsed portion of choroid or ciliary body should be removed, and the suture being needled at both ends, each needle should be passed from within outwards, an assistant carefully smoothing away the uvea with a spatula, so that the needle is passed through the sclera alone. If the eye then quickly settles down with but little inflammatory reaction, the case will probably do well, and there is little risk of sympathetic trouble in the other eye, but if this is not the case, and a chronic intractable inflammation sets in, it will be wiser not to wait too long before advising enucleation.

A wound of the ciliary body by a shot pellet which is necessarily aseptic is not of itself so dangerous that the eye should be taken out at once on this account, as has often been advised. As a rule the destruction inflicted is so severe that it is not worth while trying to save the eye; but cases occasionally arise when this is not the case, and on account of the known asepticity of the pellet such a wound is far less likely to cause sympathetic ophthalmitis than those usually seen from other causes.

TUMOURS OF THE CILIARY BODY.

Tumours involving the ciliary body cannot be dealt with in a satisfactory way except by enucleation of the globe.

ARNOLD LAWSON.

DISEASES AND AFFECTIONS OF THE CHOROID.

IN the treatment of **choroiditis**, especially in the active stage, reliance can be placed upon mercury in most cases, whether there is a syphilitic history or not. The patient should be brought rapidly under its influence. The best method of administration is by inunction or subcutaneous injection. It can also be given by the mouth, but its effects are not so rapid or apparently so marked. When the inflammation is distinctly associated with a gouty condition, anti-gout remedies and especial attention to the diet must be given. The eye should be protected from excessive light, and functional use should, as far as possible, be avoided while the condition is active. It should be recognised, however, that when the condition has quieted down, there is no reason to prohibit the usual functional use of the eyes, so long as misuse is avoided. Patients are far too often prohibited from following their occupation and the whole routine of their lives is unnecessarily upset.

Probably many isolated patches of choroiditis that have been attributed to other causes are due to localised tuberculosis. It is well in any suspected case to apply the von Pirquet cutaneous test. In cases where there is positive, and wherever there are good grounds for suspecting tuberculous infection, it is well to adopt all general precautions against tuberculosis, and open-air treatment or such other measures as may seem advisable. The active treatment with tuberculin is very much in vogue at the present time. The writer does not think that its merits have been thoroughly established, but such treatment should be borne in mind. Sympathetic ophthalmitis, so far as it affects the uveal tract, is a disease of the choroid, but its treatment will be found in a special article (*see* p. 598). **Rupture of the choroid** is a permanent lesion and is not relieved by treatment, but rest in the recumbent position until the hæmorrhage be absorbed, must be maintained to prevent detachment of the retina from being established. Detachment of the choroid from the sclerotic very rarely occurs. When it does as the result of a blow, it is due to extravasation of blood, upon the absorption of which reattachment takes place. Here, again, rest is imperative. **Tumours of the choroid** are usually sarcomatous, and demand immediate enucleation of the eyeball. It is well to divide the optic nerve as far back from the orbit as possible. Should the tumour have perforated the eyeball, the whole of the contents of the orbit should be removed and the orbit treated with Vienna paste.

R. W. DOYNE.

SYMPATHETIC OPHTHALMITIS.

So-called Sympathetic Irritation is a neurosis, and requires no special treatment except in regard to its bearing on the possible advent of sympathetic ophthalmitis, which will be mentioned in dealing with the treatment of the latter.

The treatment of Sympathetic Ophthalmitis has not advanced much, if at all, during the last fifteen years, and this is doubtless due to continued ignorance as to the exact etiology of the disease.

Prophylaxis is by far the most important feature of treatment, for when once the disease has appeared it inevitably runs a long course, too often ending in very serious damage to or complete destruction of the vision.

Something has already been said with regard to prophylactic treatment when discussing traumatic cyclitis, but in order to present matters clearly it will be best to go afresh over the whole ground.

In the first place it is to be remembered that enucleation of the injured eye is the most certain way of preventing this grave disease. Sometimes one would for cosmetic reasons prefer to eviscerate the contents of the globe and retain the shell, but it is not so safe a method as enucleation.

Secondly, enucleation, even when done early, is not absolutely certain to prevent sympathetic ophthalmitis, but the risk after enucleation is extremely small and practically negligible if removal of the eye is effected within a week of injury.

Thirdly, the conditions of injury which predispose the other eye to sympathetic inflammation are well understood; but the ratio of risk to injury is not so well known, and though after many severe injuries one can be practically certain of the disease resulting if the injured eye is not removed, yet it is also not very uncommon to see it arise after an injury of quite a mild degree. One not at all infrequently encounters cases of injury in which it is extremely difficult to make up one's mind as to the right course to adopt. Some cases are, so to speak, on the borderland, and then only a long experience and a sound judgment can dictate the right method of procedure.

The fact is that every case must be judged upon its own individual merits, and judged from as broad a standpoint as possible. It might be said that it is not worth while running any risk if the second eye is a sound one, but the assumption of such a dogma would lead to the enucleation of every eye in which the ciliary body was involved in the injury. Many such eyes make an excellent recovery with very useful or even a perfect restoration of vision, and who can say that some accident or disease might not destroy the remaining eye? Undoubtedly it is the duty of the surgeon to preserve a wounded eye, so long as the danger of doing so does not outweigh the advantage of retaining it; and the difficulty lies in recognising the point where the risk oversteps the boundary of prudence.

A few general rules may serve as guides:

(1) An eye injured beyond recovery should always be enucleated. This class includes injuries by which the vision is at once destroyed, and cases in which, although some vision may be retained for a time, the injury is so severe that the eye will be eventually destroyed.

(2) In cases of perforation of the globe by a foreign body that cannot be extracted, which exhibit persistent irritability, accompanied by severe degenerative, or inflammatory processes, the prognosis is always very grave, and enucleation should be performed so soon as the trend of affairs become manifest.

(3) Rupture of the globe with extensive laceration of the ciliary body is a very dangerous form of injury, and the eye should be removed even if some sight is present.

(4) In cases of incised non-lacerating wounds of the globe an attempt should always be made to save the eye, even if the wound is an extensive one, provided that there is a good probability of saving useful sight, and that the injury is seen and treated within a short time of its occurrence. The wound should be treated as described under Traumatic Cyclitis. A few days, or at most a fortnight, will enable the experienced surgeon to gauge very accurately the prognosis, and the eye can then be enucleated if necessary.

(5) Cases where a small foreign body, such as a chip of metal, has entered the globe, and has been successfully removed, but the eye will not quiet down and there is much weakness and photophobia of its fellow as well, often present difficulty. Many such cases are complicated by traumatic cataract and chronic irido-cyclitis, and although the risk of sympathetic inflammation in the other eye may seem extremely remote if the foreign body has been removed within a short time of its penetration, still a steady persistence of inflammatory symptoms accompanied by irritation of the other eye is disquieting and is undoubtedly dangerous. When it becomes evident that the final result at the best must be a very damaged organ, and that convalescence is going to be indefinitely prolonged,

it will be wise, provided that the other eye is visually good, to enucleate.

(6) Eyes which have already been lost by past injury, and which are painful, or exciting symptoms of lacrimation and photophobia in the other, should always be removed.

(7) No substitute for enucleation is permissible in any case of injury where removal of the globe is considered advisable, and in cases of deferred enucleation, *i.e.*, when some weeks have elapsed since the injury, it is a wise precaution to cut the optic nerve as far back in the orbit as possible.

Curative Treatment.—When sympathetic inflammation has become an accomplished fact, the injured or exciting eye should *not* be removed if any sight remains. Enucleation will not affect the course of the inflammation when organic changes have once commenced, and it is possible that the injured eye may eventually prove the better of the two.

The treatment of the sympathising eye is often most discouraging, and matters will in some cases go steadily from bad to worse whatever is done or attempted. At the best the disease will run an extremely long course extending over many months, during the whole of which the patient must be kept under close observation and continued treatment. The plastic irido-cylcitis must be combated by full doses of atropine accompanied by fomentations, hot bathings, blisters and such like, as recommended in the treatment of iritis.

Should the iris become sealed down to the lens capsule and symptoms of secondary glaucoma supervene, the case is desperate. Iridectomy is probably impossible, and, if accomplished, useless, as fresh adhesions will speedily seal afresh the lips of the coloboma. The best chance of saving such an eye is the performance of a sclerotomy after Herbert's method, or a trephining operation as devised by Elliott or Fergus; but these operations are too recent for any dogmatic statement to be made as to the likelihood of their permanent benefit in these cases. If the lens becomes opaque, an attempt to extract it may be made when the eye is quiet, but the operation is very risky and difficult.

As regards *drugs,* the most satisfactory one, in our opinion, is mercury, and this should be energetically tried. Inunction is the method least likely to upset the patient, and iodides may at the same time be given internally. Some writers advocate the subconjunctival injections of the perchloride or other salt, but personally we object to all subconjunctival injections. They are very painful, and we have never been able to convince ourselves that they had any advantage over other methods. Large doses of sodium salicylate seem in some cases to relieve when mercury does not do so, and should be tried if the latter drug fails. Aspirin in very large doses has also been recommended, but it is not altogether a safe drug when employed in this way. Injections of pilocarpine are also favoured by some writers.

The patient's general health must be supported during this most trying ordeal. The mental effect of long-continued treatment and inability to use the eyes is often very marked, and needs very tactful management. Darkened rooms are a mistake, and the effect of subdued light should be obtained by tinted glasses. There may not be much difference in the two treatments at first glance, but the consciousness of there being surrounding light makes an enormous difference to a patient who is not totally blind, and there is not nearly so much depression in consequence. A good liberal diet should be given, and tonics should take the place of other drugs, if it is evident that the general health is becoming impaired.

ARNOLD LAWSON.

SUPPLEMENTARY NOTE ON THE TREATMENT OF SYMPATHETIC OPHTHALMITIS.

Since the above article was written, an important communication has been made by Messrs. C. Price Jones and S. H. Browning on the subject of the blood in patients afflicted with Sympathetic Ophthalmitis (B. M. Journal, June 17th, 1911).

An examination of nine consecutive cases of this disease showed hat in all there was a great increase from the normal in the elative percentage of the large mononuclear cells, associated with a iminished percentage of polymorphonuclear leucocytes—a conition which suggested a protozoal and not a bacillary infection.

Salvarsan was administered in two of these cases and was llowed by remarkable changes—the mononuclear cells rapidly iminishing and the polymorphonuclear cells rapidly increasing number. These changes seem to support the theory of a rotozoal infection. Although this note appeared but six months go, Messrs. Jones and Browning's observations have been verified quite a number of cases, but the exact value of salvarsan cannot estimated at the present time. There is reason to fear that its nefits are but short-lived in some cases, at any rate, though ssibly this may be due to present lack of knowledge as to the sage and the frequency of administration needed to effect a cure.

ARNOLD LAWSON.

GLAUCOMA.

Acute idiopathic glaucoma requires immediate and active treatment. The cases of hopelessly blind patients who have neglected treatment are fortunately becoming fewer year by year, but still even at the present day patients are far too often left until "they are well enough to bear the journey" or "until the violent bilious attack (so-called) has passed off," before submitting to expert treatment.

It is possible, especially in the cases which have been provoked by the use of a mydriatic, that the attack may be cut short by the frequent use of eserine (gr. 1 ad. ℥j) and cocaine (2 per cent.) and free purgation, but if the symptoms do not promptly yield, operation should be resorted to without delay. The plan suggested by Priestley Smith, of performing a *posterior sclerotomy* to relieve the acute symptoms, in order that the iridectomy, or whatever operative procedure may be adopted, can be performed under more favourable conditions, is of great value. The procedure is simple and should be thus performed: The eye should be rendered anæsthetic by cocaine and a speculum inserted between the lids. The eye should be seized by fixation forceps and the patient directed to look upwards as far as possible. The point of a Graefe knife should then be directed to the fornix of the conjunctival sac of the lower lid with the edge of the knife towards the cornea, and should be thrust through the sclerotic as far back as possible; the blade should then be rotated on itself, so as to open the wound and allow the serum to escape, and be then withdrawn. The object of keeping the edge of the knife towards the cornea is to prevent an undue wound being made. Should the patient strain, the eye will be always more turned up and the back of the knife will be pressed against the sclerotic. If, however, under these conditions the edge of the knife is away from the cornea, it might lead to too big a wound being made. The risk is not, however, very great and the operation is a simple one. The only real danger lies in not puncturing the sclerotic far enough towards the equator and pushing the knife through the ciliary body, which extends much further back than would be supposed. When this occurs, blood will be seen to flow into the anterior chamber. Sometimes, the tension does not go down at once, and the surgeon may be tempted to make another

re. If the tension is taken half an hour after the sclerotomy
en performed, it will be found generally to have fallen. If,
r, this is not the case, which may sometimes occur, there is
m in making a second puncture in another place. If this
procedure were adopted promptly by surgeons who do not
mselves capable of performing the more delicate operation of
my, many an eye would be saved. Even if a Graefe knife
available, a tenotomy or other small-bladed knife may be
it is better to make an unnecessarily large incision than not
ne at all in urgent cases. Within a day or two of the sclero-
n *iridectomy* in nearly every case should be performed, in
which the corneal incision should be carried well back
the sclero-corneal margin, in order that the iris may be
d from its base. The failure of many cases of iridectomy tc
the condition has been due to the incision being made too far
l. The operation is usually performed thus : The patient is
under a general anæsthetic, and after the eye and conjunc-
c have been freely douched with sterile water or very weak
tic lotion, a speculum is placed between the lids and the eye-
hich is fixed by seizing the conjunctiva with forceps, either
the cornea or by its side beneath the point at which the
-puncture will be made. A Graefe knife is then inserted 2
illimetres from the corneal margin and carried across the
r chamber, to emerge at a corresponding point at the opposite
the cornea. The section is then completed by long sawing
ents (one movement may frequently be found sufficient),
g the incision rather further into the sclerotic than the
l puncture and counter-puncture. The eye then may be fixed
assistant; the iris forceps is introduced into the wound and
seized rather at one side of the section and withdrawn. One
nd free cut with the scissors should be made into it at the
e limit of the corneal wound, and then it should be torn rather
t from its base towards the other limit of the corneal wound.
should be more freely withdrawn from the eye and cut off
the surface of the wound. If caught in the angles of the
, as is often the case, the iris should be carefully replaced
the anterior chamber with a spatula or curette. Eserine
hould then be placed in the other eye, and both should be
though not tightly bandaged and the patient kept quietly in
til the anterior chamber has been closed for three or four

points to be observed in performing the operation are
The section should not be too large, about one quarter or

less of the corneal circle is sufficient, and it should be begun slowly, so as to allow the aqueous to escape slowly. A sudden diminution in tension increases the danger of a choroidal hæmorrhage, which leads to immediate destruction of the eye. Sometimes the iris is tightly jambed in the angles of the wound; too much "fiddling about" to disengage it is dangerous and should not be attempted, and many think the operation has a better chance of success if the iris is tangled in the wound, helping thereby to produce a tiny fistula. The dragging on the iris while the portion is being excised leads generally to very free hæmorrhage into the anterior chamber, and a long time may be needed for its absorption. Often the corneal wound takes many days to close, and though anxiety is felt while the wound remains open, yet in the end these cases that leak the longest produce the better results. Prolonged leaking, however, is very apt to set up iritis and adhesion of iris to the lens, although here, again, it has been observed that such cases are among those that do best so far as reduction of tension is concerned. Many experienced surgeons prefer local anæsthesia, thus avoiding the danger of retching and vomiting that is liable to occur after general anæsthesia. However, for the inexperienced the latter is probably the safer course. Some surgeons prefer a keratome to a Graefe knife, introducing the point behind the upper margin of the cornea. The operation tends to provoke an attack of glaucoma in the other eye ; hence the necessity of using eserine drops in it until the patient be convalescent.

The treatment of **chronic and intermittent glaucoma** is one of great responsibility. The writer holds very strongly the view that as soon as definite symptoms of glaucoma have been established, even if vision be perfectly normal, operation should not be delayed. The chances of success are very much greater when the operation is performed early before the eye has become generally pathological and the base of the iris has firmly blocked the filtration angle. The prejudice that used to exist against operation in chronic glaucoma arose from it being deferred until too late. The prognosis of chronic glaucoma, if the operation is performed early, is, on the whole, good, and it becomes worse the longer the operation be delayed. The fact that the acuity of vision is generally somewhat lowered by the operation should not restrain the surgeon from advising its performance. The operation is a delicate one, and is not, of course, without its risks. Sloughing of the wound and suppuration of the eye may take place, but this risk may be reduced by taking due precautions ; but no precaution can guard against the rupture of a choroidal vessel, if degenerated, when the tension is suddenly lowered by the necessary incision.

Perhaps Priestley Smith's posterior sclerotomy a day or two before may tend to prevent this accident by allowing gradual lowering of tension instead of a sudden one, but the cases in which it occurs are, in the writer's experience, more often those where there is no great rise in tension. Lately there have been introduced several modifications of this operation, as those of Lagrange, Herbert and others. The alternative of using a small trephine and of making an iridectomy through the opening is certainly an easier and probably a safer procedure than the ordinary iridectomy incision. Probably, a well-performed iridectomy with the incision far back from the sclerotic is the more effectual, but especially in elderly people, and in chronic glaucoma, the reduced risks in trephining may be a reason for selecting it.

The operation may be performed under a general or local anæsthesia. The eye is prepared as for iridectomy, a flap of conjunctiva is raised with scissors above the cornea and turned forward as far as possible on to the cornea, and the trephine applied just at the point where the conjunctiva is reflected. The surgeon can detect when the thickness of the cornea has been penetrated and the trephined disc can be picked up with forceps, and if not completely severed all round, the section can be completed with scissors. The iris then bulges into the wound; it should be seized with forceps, drawn well out of the wound and cut off. The conjunctival flap is then replaced and the eye treated as in iridectomy.

In performing the iridectomy in this operation, as well as in the case of the usual peripheral section, the writer, in suitable cases, is in the habit of button-holing the iris by tearing it from its base and cutting it so as to leave the sphincter intact, thus preserving more completely the power of contracting the pupil. The cases have done extremely well; and it is probable that the object of the operation has been obtained, namely, the more satisfactory withdrawal of the base of the iris from the angle of the chamber by preservation of the sphincter iridis. The complications that may occur are using the trephine too far back, so that the anterior chamber is not opened, or pushing the trephined disc into the anterior chamber.

The alternative to treatment by operation is the continued use of drops that produce myosis, as eserine or pilocarpine. Eserine is more powerful in its action, but it does not keep long in a watery solution and causes some conjunctival irritation. It is best used in the shape of lamellæ with gelatine as a basis. For continued use pilocarpine should generally be selected. It should be borne in mind that these drugs should be used as weak and as infrequently as is consistent with the desired effect being produced. The strength generally employed is about ¼ to 1 per cent. of pilocarpine hydrochloride or eserine sulphate, and it should be used from once or twice a week to two or three times a day. These drugs may with advantage be combined with 1 or 2 per cent. of hydrochlorate of cocaine.

In cases where the patients are between forty and sixty, treatment by operation should be selected. Patients of seventy and over, in whom the disease is very chronic and who have a substantial field left to them, it may be advisable to treat with myotics, hoping that by their use the progress of the disease may be so delayed that sight will last during their remaining years. In all cases of hæmorrhagic glaucoma treatment by a myotic should be preferred to operation. There are a good many surgeons, however, who prefer to persevere with a myotic until operation becomes imperative, and if the surgeon feels that he is performing his duty to his patient in taking this course, which is manifestly a simpler and easier one for him, then he should act accordingly, but the writer gives a word of caution against simply adopting the procedure because it is simpler and easier. Naturally, it is a course the patient would rather follow, and he can be easily influenced in this direction, whereas great responsibilities are incurred by advising a patient to undergo an operation, remembering the risks that are incurred thereby.

R. W. DOYNE.

CATARACT.

THE consideration of this subject may be divided into the following heads: (1) Juvenile cataracts, including lamellar cataracts; (2) Senile cataract; (3) Traumatic cataract; (4) After-cataract; (5) Secondary cataract, *i.e.*, cataract associated with and following upon other diseases of the eye.

It must firstly be premised that cataract only requires treatment when it is of such a nature as to seriously impair sight, or, rather, to impair it to such an extent that the only alternative, viz., removal of the lens with all the disadvantages accruing to this treatment, is considered preferable to the disability caused by the opacity.

For it must be borne in mind that, with our present knowledge, the only way to dispose of an opacity in the lens is to dispose of the lens itself, and the latter involves disposal of the accommodation as well, and impaired sight with the power of accommodation may be far better for general purposes than an improved sight without accommodation. Aphakia is a terrible drawback, especially to young people, and this aspect of the case always demands a most careful consideration.

JUVENILE CATARACTS.

This class includes many varieties of cataract, conveniently divided into "complete" and "incomplete" varieties.

The complete varieties consist of (1) Shrunken, malformed lenses; and (2) The complete milky cataract of childhood.

The incomplete varieties are numerous. The most important is lamellar cataract, whilst the others consist of the partial opacities caused by anterior and posterior polar cataracts, tags of capsulo-pupillary membrane, dotted cataracts, coralliform cataracts, etc.

Shrunken Malformed Lenses.—The condition is often bilateral, and the eyes affected are often of the microphthalmic type. If there is direct evidence of light perception, the removal of these remnants should be done in early infancy, as they usually completely block the pupil. The latter is frequently contracted and irresponsive to mydriatics, which makes the removal more difficult. Further, if not removed, early nystagmus will for a certainty develop in the course of the second year, and will then probably persist during life. At the same time no operative measures are advisable until the child's digestion is well established, and the child should also be weaned, so that the time of election is after six months of age and before twelve months of age.

As a rule, no result will follow an attempt to break up the lens and dissolve it by means of the aqueous, but there is no harm in passing a needle into the anterior chamber and trying this method. If this attempt fails, the best plan is to make a fair-sized incision into the anterior chamber with a keratome, and then, passing a pair of straight iris forceps down to the lens, to seize it and drag it out of the eye. Sometimes a little vitreous will escape with the lens, but if not much backward pressure is exerted in seizing the lens, the removal may generally be effected with very little disturbance of any sort to the eye. The corneal incision should be placed well inside the limbus to avoid any prolapse of iris. The eye should be kept tied up until the corneal wound is well healed.

Complete Milky Cataract.—In this variety the lens is usually converted into a bag of grumous material. These cataracts are easily dealt with by scratching open the capsule with a lens needle, upon which the lens will very likely empty itself into the anterior chamber. These may be left to dissolution by the aqueous, which will speedily occur, but if the lens is very fluid there is considerable risk of acute glaucoma being set up by the rapid swelling of the *débris* before dissolution takes place. Consequently the surgeon should be prepared in these cases to go on immediately to perform a curette evacution of the lens, as described in dealing with Lamellar Cataract. The eye should subsequently be tied up for a few days, and kept under the influence of a mydriatic until all irritation has disappeared. If the surgeon decides to leave the lens material to be disposed of by the aqueous he must keep a sharp look-out for glaucoma, which will be ushered in by increasing redness, photophobia, and heightening tension of the globe. On the first indications of this complication a curette evacuation should be performed without delay.

Lamellar Cataract.—This form of cataract varies enormously in its density and consequent effect upon vision. The ring of opacity may be so delicate that the unaided vision is sufficient for all practical purposes. Others, again, by the help of glasses attain the same result; whilst, on the other hand, in extremely dense cases vision is almost annulled. It is only when it is obvious a child's career is going to be marred by the defect to vision ca by the cataracts that it is justifiable to interfere, and it is as wel to have a few broad rules which may help to a right conclusion in doubtful cases, which are not few in number.

In the first place there are two recognised methods of dealing with lamellar cataract: (1) Iridectomy; (2) Removal of the lens by dissolution in the aqueous humour. The object of iridectomy is to expose a portion of the clear periphery of the lens, and thus to produce a clearer macular image. At first sight it appears the ideal method. The accommodation is not disturbed, the operation is simple, the risk is small, the time required is short, and the coloboma can be made of small size, so that there need not on this account be much blurring from the formation of diffusion circles. It used to be said that an optical iridectomy should always be placed downwards and inwards, so as to lie in the axis of direct vision; but this is, of course, a fallacy, and no matter where the opening is made, rays of light proceeding through the coloboma will be focussed at the macula lutea. As a matter of fact, iridectomy is an exceedingly disappointing operation, and the visual results are usually poor. In the majority of cases of lamellar cataract there is a considerable amount of vision obtained through the affected portion of the lens, although the appreciation of detail may be indifferent. An enlargement of the pupil does not prevent light from still passing through the cataractous portion of the lens, and consequently the blurring perceived after the iridectomy is nearly, if not quite, as apparent as before, with the result that no marked improvement in sight is obtained. It is only in cases of an extremely dense nature, in which the ring of opacity is small, that iridectomy is likely to be of much value, and even then the refraction of the clear portion of the lens may be so irregular that exposing it gives but an indifferent result. Thus, before suggesting this method of treatment, the pupil should always be dilated with a mydriatic, and the effect of its dilation upon vision carefully noted.

Thus, then, the second method, viz., the removal of the lens, is the one the advisability of which we shall have to consider in the majority of cases.

Inasmuch as the disease is always bi-lateral we must not only consider the qualifications for interference in one eye, but the further question as to the propriety in dealing with the second as well. With regard to this point it is as well to urge once again the advantage of retaining the power of accommodation, so that in cases where the sight is sufficiently good to make accommodation of distinct value only one eye should be treated. Thus, if a patient has at most $V=\frac{6}{18}$, we think that is an insufficient modicum the substance of the lens by raising the handle of the needle and at the same time slightly withdrawing it. One or two other incisions made in a similar manner will freely lacerate the lens and capsule, and thoroughly expose it to the aqueous, which at once commences to permeate it. Care should be exercised as regards two points. By passing the needle obliquely the aqueous is not lost during the manipulation, an accident which will necessitate cessation of further procedure. Secondly, the needle must not be passed so deeply as to perforate the lens and wound the vitreous. Some needles are provided with a shoulder, which prevents the needle being thrust too deeply. Thirdly, the laceration should not be too free. Extensive laceration will mean rapid swelling of the lens, and this may bring about glaucoma and severe congestion of the globe, which is precisely what we wish to avoid.

As soon as the surgeon considers that enough has been done the needle is withdrawn, the speculum removed, and a pad and bandage applied for two or three days, after which dark glasses are substituted until all photophobia has passed away.

During the whole process of dissolution the eye must be kept under the influence of atropine, and special care taken to avoid exposure to cold and wet, as there is a marked tendency for iritis to occur, so long as any lens *débris* is unabsorbed.

Now in a large proportion of cases this is all that is necessary to bring about the desired result, except that later on a second needling to cut through the capsule of the lens may be required. The latter often closes over the pupil, and having become opaque, a good visual result is not obtained until a cut is made in it to re-open the pupil. This second needling is performed in a similar way to the first, remembering that the needle should be passed according to the direction in which it is desired to make the cut, that is, at the outer limbus for a horizontal and at the upper limbus for a vertical cut. (For further details *see* Discission of After-cataract, p. 634.)

The length of time required for the absorption of the lens if everything goes smoothly will to a certain extent depend on the freedom of the laceration in the first instance; but supposing no untoward event, such as glaucoma, supervenes, it will take about three to five months.

If everything is going on smoothly, it is a mistake, in our opinion, to interfere. Undoubtedly the process may be much hastened by removing the swollen lens *débris* by an incision into the anterior chamber (Curette Evacuation, *vide infra*), and not infrequently one is compelled to this course on account of the advent of glaucomatous symptoms. Some surgeons purposely advocate extensive laceration of the lens with the view of removing it within a few days, but this is, we think, most unwise. The operation of curette evacuation is not unattended with risk, and not a few eyes have been lost in consequence. Time is of no particular object in these cases, and we are sure that after the first interference it is much the wiser and safer course to leave the rest to nature, so far as it is possible to do so.

Curette Evacuation.—Linear Extraction of the Lens.—If it is found necessary or advisable to remove the lens, the following method should be adopted. Hypertension of the globe will be soon indicated by pain and increasing redness, and upon the first appearance of these symptoms the operation should be undertaken with the least possible delay. In a young child and in cases where the eye is much congested a general anæsthetic will be required.

Instruments required are: Speculum, fixation forceps, broad needle or keratome, curette, spatula.

A free incision is made through the cornea well within the limbus, preferably at some point in the upper segment of the cornea where any slight remaining scar will be covered by the upper lid. The opening should be free so as to permit of the passage of the large fragments, and therefore a fair-sized instrument should be selected. As the cutting instrument is withdrawn it is made to slightly depress the posterior lip of the incision, which is thus made to gape. The aqueous immediately rushes out, carrying with it fragments of the lens, and in this way a large portion of the lens may be removed without further procedure. Care must be taken, however, not to let the aqueous escape with too sudden a rush, which from the sudden release of pressure might cause the hyaloid to rupture and the vitreous to come forward into the anterior chamber. If such a catastrophe occurs, the eye must at once be closed up.

The needle or keratome is now laid aside and a curette is gently thrust well into the empty anterior chamber and held there. With a spatula in the other hand the surgeon makes a gentle backward pressure on the cornea at various points, with the intent of urging the remaining portions of the lens along the curette, which at the same time is made to slightly depress the posterior lip of the incision. The curette then acts much as a sluice, and with a gentle persuasion the lens can be almost entirely got away, provided that it has been sufficiently broken up by the aqueous or by the point of the needle, which can be used when making the incision as an extra help in this direction. As the curette becomes blocked with material it is removed, dipped in a sterile solution and re-introduced. No undue force must be employed for fear of rupturing the hyaloid membrane, and for this reason any lens *débris* that cannot be passed fairly easily into the wound should be left behind. If the vitreous comes forward, all manipulations must be at once stopped, for the continued presence of vitreous in the anterior chamber may lead to unpleasant consequences afterwards. Thus it may protrude into the wound and become septic, and in any case the further disappearance of the lens will be seriously delayed, if not entirely stopped, because the vitreous has no influence in creating absorption, and the aqueous will not obtain the same ready access to the lens *débris* as before. There is no operation in ophthalmic surgery which has resulted in septic infection so often as curette evacuation, and in many cases the reason has been directly attributable to the inclusion of a bead of vitreous in the wound. Should this accident be perceived, the bead must be carefully snipped off close to the wound, and the greatest care taken to keep the wound free from all contamination.

Supposing all to have gone well, and the surgeon to have removed as much of the lens material as can be easily got away, he must be careful before tying up the eye to see that the wound is free from any inclusion of *débris* or lens capsule by passing a silver spatula into the lips of the wound and brushing it as clean as possible. In spite of every care tags of capsule and minute fragments of *débris* are apt to be caught up. The former can easily be divided later on by a Lang's synechia knife, but the latter are apt to form little dense, yellowish maculæ in the cornea, which are intractable and always persist.

The eye often remains irritable for some little while, especially when there has been previous congestion and hypertension, and it may be advisable to resort to fomentations for the first few days after operation. Continued irritability may be caused by the adherence of capsule to the wound, and a little operation to free it may be required before the eye will become quiet. Atropine must be energetically used to keep the pupil dilated until all photophobia and redness have passed away.

When the lens has disappeared and the final needling of the capsule (if required) has given a nice clear pupil, glasses are ordered for constant wear as detailed in dealing with Senile Cataract. The patient, however, often prefers a weaker reading lens than after extraction of senile cataract, so that in these cases the difference between the distance and reading lens is generally represented by Sph. + 4d instead of Sph. + 6d. Other varieties of incomplete juvenile cataract, if producing sufficient impairment of vision to warrant interference, should be treated on the same lines as those just detailed for lamellar cataract.

SENILE CATARACT.

Senile cataract commonly affects both eyes. Very often one eye is affected a long time before the other, so that the lens in this eye may have become completely opaque, whilst the other is quite clear, or nearly so.

Monocular senile cataract requires no radical treatment except under exceptional circumstances. This is a point upon which we wish to insist most strongly. We are sorry to say so, but it is true that the extraction of a monocular cataract is often undertaken by those who ought to know better, and in many cases for a very obvious commercial reason. It is a blot on many a practice, and, unfortunately, there will continue to be plenty of unscrupulous surgeons who will not hesitate to advise and perform operation so long as the general public are ignorant of the aspects of the case.

The reasons why monocular senile cataract should be left alone are simple and obvious. In the first place, operation can result in no practical advantage to the patient whilst the other lens is clear. If there has been binocular vision in the past, a successful operation will result in attempts to renew it which are fruitless either with or without correcting lenses, and the result is merely to cause confusion and diplopia. Indeed, if the unoperated eye has very good vision, the patient, who will instinctively prefer to use this eye, will almost certainly wear a shade over the operated eye to obliterate its image. In such a case positive harm has been done to the patient who has gone through the anxiety and disturbance of the operation to no purpose. One inducement to operation often held out by the surgeon, viz., that the eye will by removal of the cataract be ready for use when the other eye gets bad, is unsound and wrong, because the vast majority of cases of senile cataract occur in old people in whom the prospect of life is very limited, and one good-seeing eye, sufficient for the ordinary requirements of an old person, may persist for the remainder of life. Another frequent and plausible excuse is, that if operation is delayed the cataract *may* become over-mature. As a matter of fact, a cataract may remain mature for many years without showing any signs of hypermaturity, and until the signs of shrinkage and degeneration, which indicate hypermaturity, actually begin to show themselves there is no ground for assuming that they will set in.

There are a few exceptions to this rule of not operating on monocular senile cataract, and the most frequently occurring one is furnished by the occupation of the patient. Thus the presence of a completely blind side may be a source of danger to one whose business takes him into busy traffic, or, as in the case of a porter, exposes him to an increased risk from passing trains. Commencing hypermaturity is another reason for operating, and again, if the patient happens to be still on the young side of sixty and a woman, she may, for cosmetic reasons, elect to have the cataract removed, in which case operation is justifiable if the drawbacks to it are fully explained.

It must be understood, therefore, that in the following article the treatment, so far as operation is concerned, refers to cases of bi-lateral cataract.

The treatment of senile cataract is best described in three stages: The Ante-operative; The Operative; and The Post-operative.

Ante-operative Treatment.—The duration of the stage during which senile cataract is maturing for operation is often a very lengthy one. This is especially the case in the peri-nuclear variety, where the opacity commences and spreads chiefly from the area about the lens nucleus. From the situation of the opacity, which invades the pupillary area from the start, the loss of vision is very great at quite an early stage, and as these cataracts are characterised as a rule by extreme slowness in progression towards maturity, the patient has often to go through a very tedious time before anything radical can be done towards permanent relief. Cortical cataracts, commencing as striate opacities springing from the periphery or extra-pupillary portion of the lens, naturally do not affect vision nearly so soon, and frequently patients can see sufficiently well to pick out fairly large type within a few months of complete obscuration. These cataracts also progress with very varying rapidity. They may, like the peri-nuclear class, be extremely slow, and may in many cases remain quite stationary for a number of years. I have personal knowledge of a case of this kind where cataract in both eyes has been recognised for twenty-seven years and the patient is still able to read and work. On the other hand, the process of maturation may occupy a few months only, and any number of variations between these two extremes are encountered. Very much depends on influences of which we are at present ignorant, and as a rule the surgeon should be extremely guarded in giving any opinion as to the time that will elapse before an operation can be performed. All the same, there are certain points which serve as some sort of guide. Cataracts commencing in early middle life are generally fairly rapid, and, speaking generally, the younger the patient the more rapid is the progress of the opacity. Cataracts which occur in the course of some severe constitutional disease, such as Bright's disease or diabetes, or follow after some particularly exhausting illness, such as dysentery and sprue, are also as a rule rapid in their progression. It has already been pointed out that peri-nuclear cataracts are invariably slow, and, speaking generally, it may be said that cataracts which are characterised by the appearance of isolated spicules or clumps of opacity rather than a tendency to circumferential striation progress but slowly to maturation.

Now, it is not as a rule advisable to operate before maturity is reached or nearly reached, because of the difficulty in delivering the non-opaque or partially opaque portions of the lens. All such will tend to remain behind, being sticky in composition, and though they will absorb under the influence of the aqueous humour which obtains ingress after rupturing the lens capsule, still the process of absorption is extremely irritating to the eye, and generally results in setting up a very troublesome and chronic form of irido-cyclitis, which may block the pupil with inflammatory membrane, and in some cases lead to total destruction of the sight. Luckily, in a large number of cases the progress towards maturity is more rapid in one eye than in the other, so that the patient can still read or see to get about when one eye is fit for operation. Sometimes it happens that one cataract is already mature when that in the other eye is in quite an early stage, so that the patient has still good vision and can read and work comfortably. The rule already given about monocular senile cataract should apply in such a case, and no operation be performed until it is certain that the other eye is seriously incapacitated, or will be by the time the mature cataract has been removed and the healing process completed.

From all this it will be seen that the surgeon has often a long period of inactivity through which the patient must be guided and helped.

Examination of the Eye.—In the first place a thorough examination of the fundus of each eye must be made and recorded at the first visit if the media are sufficiently clear. This will greatly help in giving a prognosis when the time comes, and will also serve as an indication to the surgeon of possible complications and dangers to be encountered. Then the question arises as to whether a patient should be informed of commencing cataract. As a rule, if the lens changes are slight and vision not seriously impaired it is wisest and kindest not to alarm the patient by mentioning the term "cataract" at this stage. If deemed advisable the relatives may be told, but cataract is a term which alarms the lay mind very much, and is best avoided so long as the patient can be kept contented.

Refraction.—The next point is to examine the refraction and prescribe glasses if possible. Commencing cataract brings about considerable refraction changes, increasing myopia and diminishing hyperopia. Thus it not infrequently happens that a hyperopic patient will wear the same reading-glasses for ten years or so, much to his or her personal satisfaction, whereas the surgeon will expect from such a history to see evidence of cataract coming on. Thus in the early stage a weak concave glass may improve the distance of a previously emmetropic patient, and often the reading is improved by giving a weaker convex lens than the patient has been in the habit of wearing.

As time goes on and the opacity increases, lenses have progressively less value; but so far as distant vision is concerned, a high concave lens (such as—20d Sph.) will often aid when held before the sight, even when the vision is too bad for low or medium-grade lenses to have any appreciable effect. After a time the patient will drop all reading-glasses and prefer to bring the book close up to the eyes. The object of this is to gain a magnified image of the object looked at, on the same principle that a jeweller approaches his head to a very fine piece of work. When this point is reached it will be found that the patient, whilst still able to decipher medium-sized print fairly well, complains that the eyes speedily tire, so that the amount of reading that can be borne is very limited. This is because the patient is overtaxing the convergence, and there are two ways of relieving this predicament. Firstly, we may try the effect of a hand-magnifier, which enlarges the print without the same necessity of approximation of the eye, and this may be used either with or without the ordinary reading-glasses as preferred. But a better way is the use of prisms, base inwards, which we have found remarkably useful. Speaking generally, we have found that a prism 2° dev. in front of each eye relieves the convergence sufficiently to enable the patient to read once more with comparative comfort, and to the prisms may be added a spherical correction regulated by the nature of the refraction.

Homatropine and Dark Glasses.—When the opacity of the lens is chiefly pupillary, strong lights and glare of any kind tend to confine and diminish vision, on account of increased contraction of the pupil. In such cases, provided that the intra-ocular tension is normal, the use of a weak solution of homatropine is permissible, in order to keep the pupil constantly a little dilated. The dose required is not more than ¼ per cent. solution, and the patient should be directed to employ it just as often, and no more, than experience soon shows to be necessary for the purpose. Generally, one drop put in every morning is sufficient, or it may be found that an application every other morning keeps the pupil well enlarged. The patient should be cautioned to discontinue the drops if any severe pain or inflammation is induced, or if no practical benefit to vision results. In other cases the situation is best met by ordering amber or smoked glasses for wear in a bright light. Patients often find, too, that a slight tint to the reading-glasses seems to make things easier, and for this purpose we prefer a weak cobalt (No. 1 or No. 2) tint.

Preliminary Iridectomy.—By this is meant the performance of a small iridectomy upwards, carried out before the lens is extracted. It is a very useful and proper treatment in a variety of circumstances, and deserves more than casual mention. One great danger of extraction of cataract in old people is the advent of iritis. This is especially apt to occur in rheumatic and gouty subjects, who comprise a large percentage of patients, and is generally due partly to the irritation induced by lens *detritus* left behind after delivery of the lens acting on an iris which has been wounded and bruised, and often in part is the result of some entanglement of the iris in the lips of the wound. Now, to a considerable extent a preliminary iridectomy does away with these risks. If an iridectomy is going to be performed as an integral part of the extraction, then, by doing this part of the operation separately, the cut edges of the iris are firmly healed, and there is less tendency for the iris to be seriously troubled by any lens *débris*. Further, the iridectomy is practically the only part of an extraction which hurts the patient at all, and if the surgeon knows he has to deal with a restless, nervous patient he may deem it wise to do the iridectomy some time before the extraction in order to avoid the risk of the patient getting out of control, as sometimes happens, and making it difficult to deliver the lens without loss of vitreous. Again, if it is known that the extraction has to be performed upon an unhealthy eye with fluid vitreous, and liable to subsequent inflammation on slight pretext, the performance of a preliminary iridectomy is advisable on both the grounds just mentioned. Lastly, if the case is one of very slow peri-nuclear cataract, a preliminary iridectomy by enlarging the pupil may give some improvement to the sight, though in our experience the improvement so obtained is slight and not of much practical value.

Some surgeons of large experience are, therefore, in the habit of always doing a preliminary iridectomy, and though we do not personally advise this course as a routine, we think that the measure is one which is very useful in a large number of cases. The objections to it are that it makes an extra operation, which is often very undesirable; and, secondly, that it involves the section for the extraction of the lens passing through a scar, and so a good conjunctival flap cannot be secured (*see also* Operation).

If it is decided to perform a preliminary iridectomy, the section should be made by a small keratome incision at the upper limbus of the cornea. The forceps, grasping as little of the iris as possible, and taking hold close to the pupillary margin, drag the iris just clear of the wound, when it is severed with a single snip from the scissors. Thus only a small coloboma is made, and the cut pillars of the iris are gently put back free of the wound before closing the eye. A pad and bandage should be worn for four to six days, after which the wound will be well healed.

Artificial Maturation of Senile Cataract.—In spite of all these various forms of palliative treatment the surgeon is sometimes hard pressed by the patient to operate before maturity is reached. The difficulty would occur far oftener were it not that it so often happens that the cataract in one eye matures considerably earlier than that in the other. Nevertheless, it is not infrequent for a patient to find himself incapacitated from reading and from all the usual daily pleasures of life whilst the cataract is still far from mature and operation seems indefinitely remote.

On this account various procedures to mature the cataract artificially have been extensively tried. Of these, massage of the lens either directly by a curette introduced into the anterior chamber, or indirectly through the cornea after letting out the aqueous, may be mentioned, but both methods are unreliable and dangerous. They can only act by wounding the lens capsule, and the lens may be very easily dislocated, which would render subsequent extraction much more complicated. Attempts at artificial maturation have now been practically given up, and all procedures of the kind are to be discouraged.

Operations to Extract Immature Senile Cataract.—McKeown nine years ago introduced an irrigating apparatus which has greatly simplified the difficulty of dealing with immature cataracts. If the cataract is very immature, so that delivery of the lens by the ordinary method of expression will be extremely difficult, a fine hollow silver needle connected with an irrigator by fine tubing is plunged into the lens capsule, which is distended by a few drops of sterile saline solution, and so separated in great measure from the lens itself. Expression is then carried out in the usual manner, after free laceration of the capsule with the cystotome. The sticky immature cortex left behind is then washed out of the eye by introducing into the chamber a fine silver pipette or nozzle, attached as in the case of the hollow needle to a douche containing sterile saline solution. Undoubtedly, with careful manipulation, the irrigation method of McKeown is a capital way of dealing with these cases, but it has certain disadvantages which must not be overlooked. It introduces a fresh element of risk which is certainly slight if proper care has been taken not only to ensure perfect sterility, but to prevent the flow of the saline solution from the wound into the eye. Again, it is essential that the patient be under good control, and, unfortunately, we can by no means be sure of a patient's behaviour until the operation is actually in progress. With a restless patient the nozzle cannot be introduced without considerable risk of losing vitreous. And further, in all cases where there is reason to suppose that the eye is not over-sound, the same danger of loss of vitreous is present even when dealing with a good, quiet patient. (Further details with regard to this treatment are given under Lavage of the Anterior Chamber.)

Colonel Smith's Operation of Intra-capsular Extraction of Immature Cataract.—This consists in the forcible expression of the lens in its capsule through a large section completed just within the corneal limbus. The delivery of the lens is effected by the dexterous manipulation of a strabismus hook and a spatula applied to the cornea, whereby the lower segment of the lens is first dislocated backwards, thus thrusting the upper segment towards the wound. Pressure is then directed so as to tuck the cornea under the lens, so as prevent it slipping back again and at the same time to force it into the lips of the wound, where, once engaged, it is easily delivered.

Colonel Smith has performed the operation in a large number of cases of immature cataract with a large measure of success. The necessary procedure is very highly technical, and the reader must be referred for more precise information to the monograph lately published by Colonel Smith on this subject.

It is not possible to offer a just criticism on the method at the present time. The operation has been but little tried in this country, but there is obviously a considerable risk of losing vitreous. Colonel Smith rather scoffs at the dangers attendant upon this accident; but it must not be forgotten that the mere loss of vitreous is only one of the risks incurred if vitreous flows; for no subsequent toilet of the eye can be performed, and prolapsed or incarcerated iris, persistent irido-cyclitis with its attendant complications, sympathetic ophthalmitis and sometimes suppuration, may all follow. It is true that the eye may often heal well with no complications and with an excellent visual result; but none the less, there is from loss of vitreous a serious chance that such may not be the case.

Operations for Mature Cataract.—*Preparation of the Patient.*—Great care should be exercised that the general health is in as good order as can be secured. In old people, especially, it is important that there should be no bronchial trouble or tendency to cough, and on this account we always avoid the first three months of the year when we have to deal with a very old or delicate patient.

The local condition of the eyes must also be carefully inspected. The conjunctiva of old people is very generally in a state of slight chronic irritation, which shows itself by a little gumminess of the lids in the morning and a small collection of dried muco-pus at the canthi or upon the lashes. Particularly is it important that no mucocele be present or any blocking of the tear outflow. It is always best as a routine to cover the eye about to be operated upon with a pad of white gamgee tissue for one night a day or two before operation. If any discharge is present it will always be evidenced by a stain on the white pad, in which case treatment must be given to clean the conjunctiva before operation is undertaken. A lotion containing zinc sulphate (gr. ½ ad ℥j) and boric acid (gr. 5 ad ℥j) will be found a simple and efficacious remedy in most cases. If any lacrymal trouble exists, this must be dealt with effectually by removing the lacrymal sac, should regular douching and the injection of a few drops of argyrol (15 per cent.) or other astringent seem to produce no benefit.

Anæsthetic.—A general anæsthetic should not be used except in those comparatively rare cases where the patient is too nervous to be controlled without such an aid. The disadvantages of a general anæsthetic are twofold. In the first place, the eye rolls upwards under the upper lid and the necessary manipulations are much more difficult and also more risky, as the use of the fixation forceps is necessary even in the late stages of the operation when they are most undesirable. In the second place, there is a certain risk from the sickness and straining which so frequently follow the use of ether or chloroform. Cocaine hydrochloride is still the most generally employed of the local anæsthetics, and we have never experienced nor heard of any accident following its use. A 2 per cent. solution is sufficiently strong, and six drops at an interval of three minutes between each drop is ample to ensure complete anæsthesia, except perhaps as regards the section of the iris (supposing an iridectomy is performed), which is generally a little tender. It is a good plan to put a drop or two of cocaine into the other eye as well.

Solutions.—Only simple non-irritating solutions should be employed, such as neutral saline solution or distilled water, or boric acid. To apply, as has frequently been recommended, a strong irritating solution, such as hydrarg. perchlor (1 in 2000) as a preliminary to operation is simple foolishness. It acts as a strong irritant to the sensitive conjunctiva without being of the slightest practical value, and the *raison d'être* is founded on obsolete and antique notions of pathology.

Position of Patient and Surgeon.—Light, etc.—The patient should be reclining on the back, the surgeon standing behind the patient and using the right hand for the section of the right eye and the left hand for the section of the left eye. A good direct light is most necessary, and means should always be at hand to supplement daylight by artificial aids if necessary. An assistant stands at the right side for the right operation and on the left side for left operation. Should the surgeon be unable to use the left hand he must necessarily stand in front of the patient when operating on the left eye, on whichever side he may prefer.

The Operation which is almost universally adopted is known as the 3-millimètre flap operation, and is a modification of that introduced by Von Graefe.

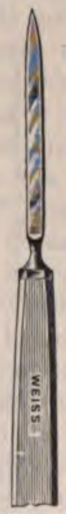

FIG. 2.—Von Graefe cataract knife. Full size and usually preferable to smaller types of knife.

Instruments required.—Knife (*see* Fig. 2), fixation forceps, speculum, iris forceps and scissors (if iridectomy is to be performed), cystotome or capsule forceps as preferred, curette (one or two), repositor. In case of need a lens spoon or lens loop (vectis) and a lid retractor should also be placed ready for use.

The operation, for purposes of description, is best described in four stages: (1) Section; (2) iridectomy; (3) delivery of lens; (4) toilet.

(1) *Section.*—The patient is directed to look somewhat downwards, in order to expose the upper corneal limbus, and fixation is made with the forceps, taking firm hold close to the lower corneal margin in

the median line. The section is all important. A bad section vastly increases the difficulties of the operation, and complicates every subsequent manipulation. The 3-millimètre flap which the title of the operation indicates to be the correct height of the section, is not to be followed literally. The diameter of the cornea varies very much, and a larger and deeper section of the cornea is often required. The surgeon must not only consider the diameter of the cornea, but must bear in mind the character of the cataract with which he is about to deal. Some cataracts are much harder than others, and the harder the cataract the larger must be the section to enable the lens to be delivered clean, with the least possible bruising of the parts, and without the employment of extra force which may result in the loss of vitreous. Notably the dark amber-coloured cataract always requires a larger section than the white or milky cataract, and the more rapidly a cataract matures the more soft, as a rule, is its consistency.

In any case the section is commenced exactly at the corneal limbus. The knife is held edge pointing upwards, so that the blade lies exactly parallel with the plane of the iris, and until this position is secured, no attempt should be made to enter the anterior chamber. When once the knife is in the proper position, it should be passed directly across the anterior chamber without any hesitation to the corresponding point on the opposite side, and if the correct angle of the incision has been gauged, and the plane of the knife is not changed, the counter-puncture must of necessity be also exactly at the corneal limbus. If these points are not attended to, the counter-puncture will fall either in front or behind the limbus, as the case may be, and if the plane of the knife is changed during the section the aqueous will escape too soon, with the result that the iris will flop in front of the knife. As soon as the counter-puncture is made, the section is rapidly completed by a few sawing movements, care being taken to keep close to the limbus throughout, and to cut a conjunctival flap of fair dimensions by turning the edge of the knife forwards after cutting through the limbus and before dividing the conjunctiva. Care should also be exercised with regard to the fixation forceps that they always exercise traction slightly away from and never pressing against the globe, and a second pair, which the assistant can manipulate, should always be handy in case the conjunctiva tears, as it is very apt to do in old people. If the iris falls in front of the knife and cannot be disengaged by lifting the knife over it, the section must be completed as above, and the cut piece of iris carefully removed afterwards.

(2) *Iridectomy.*—This is no integral part of the operation of

extraction of cataract, which can be effected quite as easily without as with an iridectomy. When no iridectomy is performed the operation is generally known as "simple extraction," to distinguish it from the operation with iridectomy. Undoubtedly, both from cosmetic consideration and also to a slight degree on visual grounds, the preservation of the round pupil and undamaged sphincter is a distinct advantage. Further, when the pupil is left intact there is not so great a likelihood of the lens capsule becoming subsequently involved in the scar, a complication which may lead to serious consequences and to which further reference is made elsewhere. However, there are counter-balancing disadvantages which are serious, and which to our mind outweigh those mentioned in favour of "simple extraction."

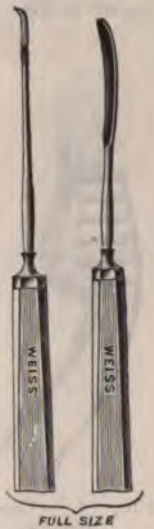

FIG. 3.—Cystotome and curette.

The most serious of these is the risk of entanglement or prolapse of the iris in the scar after the operation is completed. In a very large percentage of cases this can be avoided by careful and thorough reposition of the iris before the bandage is applied, but a small percentage of cases remain in which, with the most experienced surgeons, this accident occurs, and when it happens a second operation is at once necessary to free the iris at a time when the patient is just recovering from the effects of the first. The upshot is an iridectomy under the most disadvantageous conditions, followed as a rule by a troublesome iritis. All this risk can be prevented by a small iridectomy at the time of operation. The gap in the iris seems to act as a sluice gate, allowing the aqueous to drain away until the wound is sealed without sucking the iris itself into the wound. The disfigurement is barely noticeable unless the lids are opened very wide, and the visual results are excellent if care has been taken to remove only a very small portion of iris.

A compromise between the two operations can be effected by a buttonhole iridectomy, which means a small hole cut out of the iris between the pupillary edge and the peripheral attachment, so that a round pupil is left, as in the "simple extraction." The smallest possible portion of iris is grasped with the forceps and the section made by a single snip, without exposing the pupillary edge of the iris outside the wound. This buttonhole serves the same purpose as an ordinary iridectomy whilst maintaining a round pupil, and at first glance appears an ideal arrangement. It must, however, be done after the delivery of the lens, which is a great disadvantage. As already mentioned above, the section of the iris is the only painful part of the operation, and a late iridectomy of this sort means causing pain at a time when the effects of the cocaine are beginning to wear off and the parts consequently are becoming more sensitive. Also the patient is much more apt to lose control, jump and start under any pain at this stage, when the nerves have been already much taxed; and, further, it is to be remembered that the lens having gone and the iris having lost its support, the iridectomy is more difficult under any circumstances, and if the patient makes a sudden movement a loss of vitreous may very easily occur. The buttonhole must not be made *before* the delivery of the lens, because in this case as soon as pressure is put upon the lens to bring it into the wound, it is exceedingly likely to get caught up in the buttonhole, as in a net. This complication will necessitate division of the iris sphincter to bring about release, for attempts to disengage the lens or press it out without dividing the sphinter will cause much pain, and very likely bring about a loss of vitreous and subsequent irido-cyclitis.

On the whole, then, the most prudent course in our judgment is the routine performance of a small upward iridectomy immediately following the primary section at the corneal limbus.

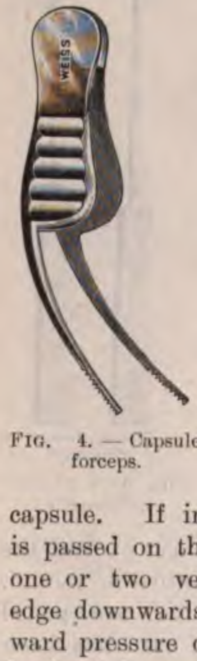

FIG. 4. — Capsule forceps.

(3) *Delivery of the Lens.* — Laying aside the fixation forceps, the surgeon next proceeds to incise or remove a portion of the anterior lens capsule. If incision is preferred, the sickle-shaped cystotome is passed on the flat to the bottom of the anterior chamber an one or two vertical cuts are made by turning the cystotome edge downwards and gently withdrawing it, making slight downward pressure on the lens in doing so. If desired, one or tw horizontal cuts can also be made and are especially desirable if th cataract is rather immature.

To remove a portion of the capsule, special capsule forcep (Fig. 4) are required. They are passed closed into the anterio chamber, then separated so as to embrace a large portion of th lens surface, after which they are closed again on to the capsule which is engaged by the forceps teeth and withdrawn. A watch-glass containing a little sterilised water should be handy, into which the forceps after withdrawal should be dipped, when any capsule removed will be floated off the forceps and become apparent to the naked eye. If no capsule has been torn off, the process must be repeated.

Either method is equally efficacious so far as preparing the lens for delivery is concerned, but the capsule forceps in actually removing a portion of the capsule has this advantage, viz., that cases so treated will not require subsequent needling in as large a proportion as those in which a cystotome has been employed. On the other hand, capsule forceps require a good deal of experience and very judicious manipulation. It is not always easy to tear a good piece of capsule away, and in attempting to do so undue pressure backwards may be put on the lens, which may be dislocated or an escape of vitreous may be brought about, especially if the latter is at all fluid.

The next step is the actual delivery of the lens. All blood clot should first be cleaned away from the lips of the wound. The patient is directed to look well down and the speculum is lifted away from the globe by the assistant. Using the back of a curette or a lens spoon, pressure is made on the lower part of the cornea directly backwards with the object of forcing the upper segment of the lens forward into the wound by backward pressure on the lower segment, whilst at the same time the wound is made to gape by the tilting forward of its anterior corneal lip. As soon as the lens appears in the wound, but not before, its delivery is expedited by stroking movements on the cornea and the backward pressure is considerably relaxed. Should attempts be made to force the lens out before it has become actually engaged in the lips of the wound, the lens is very apt to become impacted behind the posterior lip or otherwise dislocated so that delivery becomes a matter of great difficulty. When the lens does not appear readily in the wound, matters may often be helped by a second curette passed into the wound and made to slightly depress its posterior lip whilst pressure as above described is kept up with the curette in the other hand. By this means the wound is made to gape more and the equator of the lens is freed, supposing it to have become impacted. The passage of the lens through the wound should be closely followed by upward pressure on the cornea to force any detached sticky cortex into the lips, where it may be cleared away by the second curette which is passed into and swept across the face of the wound.

(4) *Toilet.*—After the lens has been safely delivered it is often apparent that some material has been left behind in spite of careful manipulation. Such detritus as remains will speedily

become absorbed unless we have to deal with an immature cataract, when a considerable amount of cortex may be left. Attempts to express this will fail and are dangerous, and resort should be had in such cases to irrigation, as described elsewhere in discussing extraction of immature cataract. The lips of the wound should now be cleansed and the iris, which is always more or less forced into the wound during expression, carefully replaced and smoothed out by a silver spatula. The greatest care must be exercised over this detail. The impaction of iris in the wound is almost always followed by inflammation and upward dragging of the pupil. It is not always easy to see, after an iridectomy, whether the iris pillars are perfectly disengaged, and sometimes they will get sucked slightly into the wound again before the anterior chamber closes, but, as a rule, a careful inspection of the shape of the coloboma will detect some huddling up of the iris in the angles of the wound if the pillars are still not free. Before finally closing the eye the spatula should be passed along the wound from one side to the other to sweep away any lens capsule that may possibly have become engaged.

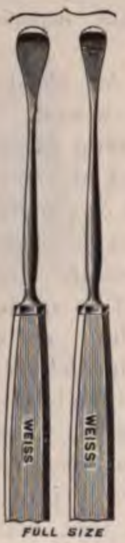

FIG. 5.—Bowman's spoon.

The speculum is then gently taken out of the eye, the upper lid being first freed, and the dressings are applied.

Complications caused by the Presentation of Vitreous Humour.—Spoon Delivery of the Lens. — This method is only adopted when the vitreous presents in the wound before or during expression of the lens or when the lens is dislocated. The appearance of vitreous is a serious mischance, always indicating a fluidity of its composition, unless indeed some undue pressure or clumsiness is responsible for forcing it forward. Its appearance plainly shows that it will be impossible to express the lens in the ordinary way without losing so much vitreous that the eye will probably be lost. Recourse is had at once to the lens spoon or wire loop. Several patterns of lens spoon have been designed, but none is better than Bowman's spoon, which is designed to displace as little vitreous as possible during its passage (*see* Fig. 5).

The speculum is lifted by the assistant so that it does not touch the eye. The patient is directed to look down and the spoon is then passed into the vitreous chamber, keeping close to the back of the lens, and directed downwards until the surgeon is sure that the lower border of the spoon is just below the lower edge of the lens. The spoon is then pressed against the back of the lens and gently withdrawn, lifting much more than pulling the lens out of the eye by keeping a firm pressure forwards all the time that withdrawal is taking place. The spoon in its passage into the eye should roughly describe an arc of a circle, being at first directed backwards over the lens and then allowed to sink by its own weight until near the bottom of the vitreous chamber, when it is directed forward to engage the lens. If the patient is not restless and the surgeon is dexterous, the lens may be removed with very little loss of vitreous even when it is quite fluid, and if the vitreous is fairly normal it is quite possible to extract the lens in this way without any loss at all.

As soon as the lens is delivered a pad and bandage must be put on at once. No attempt at reposition of the iris should be made as it is quite useless and will only involve further loss. In the majority of cases, if the loss of vitreous has not been excessive, the eye does perfectly well, the vitreous sinking back as soon as firm dressings are applied, and dragging the iris back with it. In some cases some adhesions form between the edge of the wound and the vitreous, and if this happens we must expect some bulging of the subsequent scar. Excessive loss of vitreous will very likely lead to detachment of the retina and to a chronic destructive inflammation which will ultimately destroy the eye. Should a bead of vitreous appear in the lips of the wound the day after the operation it must be snipped off close to the wound and firm pressure reapplied.

Sometimes an Expulsive Rush of Vitreous follows the Delivery of the Lens.—This is a less serious accident than presentation of the vitreous before delivery. The only thing to do is to close up the eye as quickly as possible and apply firm pressure, without attempting to repose the iris, which generally falls back into a fair position with the vitreous, as the latter sinks back upon closure of the eye.

Lavage of the Anterior Chamber.—If the cataract is rather immature and a good deal of cortical material is left behind after expression of the lens, it is a good plan to wash out the anterior chamber before closing the eye. By doing so there is much less risk of a troublesome iritis, and also the presence of unabsorbed *débris* involved in the lens capsule often makes a subsequent needling very difficult.

McKeown's metal irrigator, specially adapted for the purpose, is very convenient. This is attached to a length of rubber tubing, which in its turn is fitted over the stem of a glass undine filled with neutral saline solution. The whole apparatus is carefully boiled, and the irrigator placed submerged in sterile solution until required. The undine, the solution in which should be warm but not unduly so, is first raised to allow any air bubbles in the tube or irrigator to escape. It is then lowered, and the patient looking downwards the irrigator is then passed gently just within the wound. Then, and not till then, the undine is raised and a stream of the solution issuing from the irrigator washes the lens material into the wound, where it is cleared away by a spatula. As soon as the pupil is clear and black the irrigation is stopped, the toilet of the wound attended to as above described and the eye tied up.

Two points require attention: (1) Care must be taken not to wash anything from *without* the wound into the eye so that irrigation must not be commenced until the nozzle is well into the anterior chamber; (2) the stream must not be too forcible so that the risk of rupturing the hyaloid is avoided as far as possible.

Lastly, if the patient is very nervous and restless lavage had better not be attempted.

Post-operative Treatment.—*Dilatation of the Pupil.*—The great danger to be feared after extraction of senile cataract is inflammation of the iris and ciliary body. The most skilful operator cannot dispose of this danger, though it is, of course, enormously greater when manipulation has been excessive or clumsy. Elderly patients are often gouty or rheumatic and the iris is an exceedingly delicate membrane, very apt to resent even the slight bruising entailed by the delivery of the lens. Added to this, a certain amount of lens detritus is always left behind, and this sticky material will very quickly form adhesions between the iris and lens capsule, and then initiate a chronic and exceedingly intractable form of iritic inflammation. If the operator is content simply to tie up the ey at the completion of the operation without taking steps to preven the dangers of an occluded pupil bound down to the lens capsule he will in many cases be very disagreeably awakened to hi indiscretion after the lapse of a few days. On the other hand, if h has, by the instillation of a mydriatic, brought about at the earlies moment possible a satisfactory dilatation of the pupil, he can then, in the vast majority of cases, combat successfully any inflammation that may follow the operation, and that without much anxiety to himself or distress to the patient. Further, it is to be borne in mind that adhesions once formed between the iris and lens capsul are exceedingly difficult to break down, much more so than when the lens itself is present, the reason being that there is very littl for the iris to pull against when the lens has gone, and the dilating power of the mydriatic is therefore largely lost.

The pupil is naturally contracted after operation, and the adhesions between the iris and lens capsule are so quickly formed that unless a satisfactory mydriasis is obtained within forty-eight hours of operation it is probable that no efforts will effect it. Then, should iritis set in, the pupil will probably become entirely occluded, the inflammation will run a long, dangerous and inevitably troublesome course, involving in many cases the performance of an iridectomy later on before the patient can see at all, and in a certain number of cases the total destruction of the eye.

Thus it becomes of the greatest importance to dilate the pupil as soon as possible. Personally we always instil a drop of a sterilised 2 per cent. solution of atropine before the eye is tied up after operation. This will not have any effect until the lips of the wound become sealed down, but this should normally occur within six to eight hours after the operation, and often sooner, and the mydriatic will then be still capable of producing some result. Supposing the operation to be performed in the morning, it is a good plan to part the lids gently the same evening and instil a second drop of a similar solution of atropine. The next morning the pupil should be fairly widely dilated ; but if not, the strong solution should be used at least thrice during the second day. Once the pupil is dilated it is easy enough to keep it so, and then a 1 per cent. solution of atropine used two or three times daily will be ample, and the surgeon will in all probability, as already explained, be free from further real anxiety in the case.

Dressings.—A simple pad of gamgee tissue, cut oval or round, is all that is required. It should be cut large enough to include the orbital margin, so that the superimposed bandage does not force it against the eye.

Bandages.—It is a wise plan to shut up both eyes after a cataract extraction, because this tends to produce the greatest rest. If a patient knows he cannot see he will not try to do so, and the affected eye is therefore kept more or less immobile by using a double bandage. The best and simplest method is to use a linen flap about two inches wide fitted with tapes which enclose the ears and then passing round the head are tied over the forehead. This can be applied or removed with very little disturbance to the patient, and further it is very comfortable. The occlusion of both eyes should be maintained for at least two days, and if the patient is docile a longer period of four days is wise. After the removal of the double bandage the affected eye should be protected for a further week by a pad and a 1½-inch or 2-inch bandage, after which dark glasses should be substituted. The latter should be worn indoors so long as there is any photophobia, and outdoors until the eye has become quite white and normal in appearance for a week or two.

During the time that both eyes are occluded it is a wise plan when dealing with nervous patients to insist on a night nurse. We have known quite a number of instances where such patients have become panic-stricken at night on hearing some noise which they cannot at once understand and which they, of course, cannot investigate. Serious consequences may follow if there is nobody at hand to pacify and calm.

It is a prudent course to hobble the hand corresponding to the operated eye before the patient composes himself for sleep. There is always a risk during the moments of semi-unconsciousness, betwixt sleeping and waking, that a patient will on feeling something amiss put up the hand to the eye and rub it. We have known many eyes lost after satisfactory operations through neglecting this simple precaution. The patient will naturally tend to put up the right hand to the right eye and the left hand to the left eye, and therefore, as a rule, it is sufficient to hobble the one hand only. The easiest plan is to make a running noose, through which the patient's hand is passed, the bandage being passed under the bedclothes and attached to the end of the bed. The length of the bandage is so adjusted that the patient cannot flex the elbow beyond a right angle, and the nurse must take care that if the patient slips down in the bed the hobble is correspondingly shortened. This hobble should be worn for at least ten days after operation.

Pain and Shock.—As a rule pain is a complication which causes no trouble. Some pain always follows an extraction operation after the effects of cocaine are worn off, but it is easily borne, and if the operation is performed in the morning it should have quite passed away at night. Subsequent pain always indicates complications, and must be dealt with according to the nature of the trouble.

Some shock is generally noticeable in old people after the operation is over, and often exhibits itself by great restlessness for the first day or two, especially at night. For this reason it is a good routine to order some sedative mixture to be given the night after operation and to continue it for one or two subsequent nights, as may seem desirable. A restless night following operation may make just the determining difference between a quick or protracted convalescence; and, as pain is not usually the cause of the restlessness, it is rarely difficult to ensure a quiet night with some harmless mixture.

General Treatment.—The patient should be kept quiet in bed for a week, and during the first day or two, when the eyes are occluded and the closure of the wound not sound, it is wise to limit the diet to pounded and minced foods which are easily digested and do not require much mastication. Backache and flatulence, two very common troubles, must be treated by routine methods, and some aperient should be given at the end of the second day. One often finds that patients have considerable difficulty in evacuating the bowels satisfactorily when recumbent, and it is far better in such a case to allow the patient to sit up or use a nightstool than to strain lying down. Care must of course be taken to watch the temperature and pulse in old people, and to look out for any cough or indication of hypostatic congestion, and, indeed, in the case of many old people, it will be found advisable to let the patient sit in an armchair for part of the day before the week is up.

Lotions.—After the first day the eye should be gently bathed twice daily with boracic lotion or sterile distilled water. The latter often seems the more soothing application. It is frequently noticeable that after the lapse of a week the eye tends to get more rather than less irritable and red. In the absence of any deep-seated inflammation the probable explanation is the supervention of a little conjunctivitis induced by the prolonged closure of the lids and it is best treated by removing the bandage and adding a little zinc sulphate (gr. ½ ad ℥j) to the lotion.

Cataract Glasses.—The refraction of the normal crystalline lens is equivalent to that of a convex lens of 10 dioptres, and the latter must therefore be placed before the aphakic eye before clear distinct vision can be obtained. If the patient is previously hyperopic, a stronger lens proportionate to the defect will be required, and if myopic a lens of weaker degree. In neither case, however, does the required lens serve as a true measure of pre-existing defect. In hyperopia a weaker lens than one would expect is often preferred, whereas in myopia the loss of refraction is very great, so that a myope previously requiring a concave lens of 10 dioptres to correct the defect will require a convex lens of 4 or 5 dioptres to obtain the best results.

For reading it is generally found that a convex lens of 6 dioptres must be added to that required for distant vision.

In addition, there is generally some astigmatism produced by the healing of the wound, which requires a convex cylinder placed more or less horizontally for its adjustment, and which must be added to the spherical correction both in distance and reading glasses.

Cataract glasses often give the patient, especially an old one, a great deal of trouble before they can be worn with comfort, especially if the cylindrical correction is at all high. It is a wise plan to explain the difficulty at the time of ordering the glasses and to tell the patient to use the glasses for a very limited period at first, and not to attempt to walk outdoors in them until thoroughly accustomed to their use in the house. If a high cylinder is required, it is generally best to train the patient with a correction somewhat weaker than that to be ultimately given, the final correction being thus delayed for a few weeks.

All cataract patients should be warned not to attempt to walk down steps or stairs in glasses, and to be extremely careful in getting in or out of carriages, etc.

It is best not to order cataract glasses until about six weeks after the operation of extraction, however well the case may have progressed, and should any inflammatory complications have arisen in the course of healing, glasses should not be prescribed until the eye has been quiet for at least a month.

AFTER-CATARACTS.

Simple Capsular Opacities.—Interference with vision by an opaque capsule is of frequent occurrence after extraction of the lens. Theoretically, the capsule when torn at the time of operation should widely gape and allow of a permanently clear pupil. But, in practice, many things may combine to prevent the rent from remaining open, and thus it happens that a second or needling operation to cut a fresh hole in the opaque capsule is necessary in a large proportion of cases. It is always the anterior capsule of the lens that gives trouble in the first instance. Some months after operation a delicate web of opacity, due to degenerative changes in the posterior lens capsule, may appear, but this form of capsular opacity is much rarer, and it is generally torn open with ease. Closure of the pupil by an opaque anterior capsule may, on the other hand, give rise to great difficulty if it is not treated fairly soon. The capsule tends to get thicker and denser as time goes on, and will often form wrinkled bands stretching across the pupil, which may be extremely hard to divide.

Our motto for anterior capsular opacities should, therefore, be *early division*. The chief risk in dealing with these opacities is the pulling on the ciliary processes during the process of cutting or tearing a rent, and thereby setting up a cyclitis. It is not prudent, therefore, in any case to attempt anything until the eye has completely quieted down from the operation of extraction which gives the earliest date on which a needling operation should be performed as a month. After this time, supposing everything to be well, the sooner the opacity is dealt with the better. Of course it may happen that a clear aperture sufficiently large for good vision may be present for some months after operation, and so long as this is the case there is no reason for interference, but this is not the most usual course of events. As a rule, the pupil will very early be occupied by a fine filmy or speckled membrane, and if so, it is not wise to wait and see if the vision gets worse but to clear away the opacity as soon as possible.

The pupil should first be dilated with atropine, partly to give as large a field as possible to the operator and partly to counteract any inflammation that may possibly follow the operation. The eye is cocainised in the usual manner, and the proceeding, provided that no undue force is used, is perfectly painless.

The operator stands as for extraction and the instruments required are: (1) Fixation forceps; (2) needle; (3) speculum.

The operation is most easily performed by the help of a strong artificial light focussed on the eye, the room being otherwise in complete darkness.

The surgeon should first endeavour to ascertain in what direction the cut in the capsule should be made in order to get most gaping of the cut edges, as well as the situation in which the capsule appears to be most easily divided, bearing in mind that the opening should be as central as possible, so that it may be well exposed when the effects of the mydriatic have worn off. In many cases there is at some point an involvement of the capsule in the lips of the wound which tends to drag the capsule upwards, in which case an oblique or horizontal cut will give the best result, and in all cases it is best not to interfere with any particularly dense band of capsule if it can be avoided.

The eye is held by fixation forceps close to the cornea, and in the line of the cut to be made but on the opposite side, and the needle is then passed obliquely into the anterior chamber at the limbus on the flat. When it has reached the capsule, the needle is then turned so that its edge is *exactly* at right angles to the plane of the surface to be cut. Its point is then thrust through the capsule by a delicate movement of rotation accompanied by slight withdrawal of the needle; at the same time the capsule is partly torn, partly cut in the desired direction. If the first endeavour is not successful, further similar cutting movements must be made until the capsule gives way. Two things must be remembered: Firstly, that the needle edge, which, of course, should be as sharp as possible, must lie exactly as indicated above before attempting to cut: if it is not so placed, the opening will partake much more of a tear than a cut, involving much greater force and being much more difficult to accomplish. Secondly, the cutting cannot be effected in the same way as a knife cuts a piece of bread. The needle is fixed in the cornea and sawing movements are impossible, so that its cutting power can only be exercised by raising the handle, *i.e.*, rotating the point of the needle round a fixed point in the cornea, combined with slight withdrawal of the point as the handle is raised.

As soon as the opening is satisfactorily made the needle is withdrawn and a bandage applied. The latter should be kept on for a couple of days and atropine instilled daily until all symptoms of irritation have passed away.

Opacities formed by the posterior capsule of the lens should be dealt with in a precisely similar way, and being very delicate are easily divided.

It sometimes happens that the surgeon fails in his endeavour to obtain a good opening. After a few cutting movements the aqueous will probably begin to dribble away, and when the anterior chamber is emptied it is impossible to continue. Further, there is distinct risk in using force or prolonging manipulation, and it will very speedily become manifest whether success is going to follow. If care has been taken to follow the axiom of early needling, failure will not often occur in uncomplicated cases; but assuming that it has, then three courses are open to the surgeon. He can either (1) try a second similar operation, cutting in a different direction to the first or selecting another spot; or (2) he can operate a second time, using two needles; or (3) he can divide the capsule by means of a scissors operation or with a Ziegler's sickle-knife. In every case the eye must have quieted down before anything further is done.

No comment is required with regard to the first alternative. The surgeon should be able to obtain all the information he requires with regard to the probable success of further needling at the first operation.

With regard to an attempt to divide the capsule by two needles, this is a method we cannot personally advise. The idea is to use one needle as a *point d'appui*, passing it straight into the capsule at one side of the cornea and fixing it there, where it acts as a support, whilst the other needle does the cutting. The first needle takes the pull exerted by the cutting needle, and so a much greater force to tear a rent in the capsule can be exercised without dragging on the ciliary processes. As a matter of fact, a satisfactory manipulation of the two needles is very difficult, partly because the cornea becomes wrinkled so that the surgeon cannot well see what he is doing, and partly because the aqueous is very easily lost.

A Ziegler's sickle-knife (Fig. 4) will often divide tough bands of capsule after a needle has failed, and when it is obvious that difficulty in obtaining a good opening will be encountered it is the instrument to choose rather than the ordinary discission needle. The cut is made by a series of fine sawing movements for which the shape of the knife is well adapted. It is introduced on the flat and then turned so as to allow the fine curved point to sink into the membrane before commencing to cut.

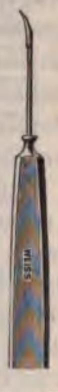

FIG. 6. — Ziegler's sickle knife.

The best plan in many cases is to resort to a scissors operation, the details of which will be described in the next section.

Complicated Capsular Opacities.—By this term is indicated the opacities that are the result of iritis or cyclitis supervening after an extraction. Organised inflammatory exudate is added to the capsule, and the membrane may thus form a dense, tough web which shuts off the pupil and entirely destroys sight. To attempt to needle such a membrane would not only be attended by failure, but probably be followed by disaster, for almost certainly a fresh attack of inflammation would be induced, which would make matters worse than before. Not a few of these cases are due to extensive involvement of the iris or lens capsule, or both, in the scar, which sets up a most intractable form of chronic cyclitis and iritis. Some form of treatment becomes imperative in many cases, not only to endeavour to restore sight, but because the blocked pupil induces a secondary glaucoma which will entirely destroy the eye if not relieved.

The most satisfactory method to adopt is a "scissors operation" or *capsulotomy*. All acute symptoms must have passed away before anything is attempted.

The instruments required are: (1) Speculum; (2) lance, broad needle or keratome; (3) a fine pair of De Wecker's forceps-scissors; (4) fixation forceps. As a rule, cocaine anæsthesia is sufficient.

The object of the operation is not only to cut an opening through the membrane, but to cut it so that the opening gapes well. To effect this, the opening is best made at right angles to the line of traction. In the majority of cases this is upwards as already explained, and the opening should then be horizontal. Sometimes the pupil is so drawn upwards that it disappears under cover of the upper lid when the gaze is directed forwards, and then the cut must be made through the iris below the updrawn pupil. Should there be no evidence of traction, then the surgeon must exercise his discretion as to whether he makes a vertical or horizontal opening, but in all cases the best result is obtained if the cut is made to involve the sphincter of the pupil as well as the membrane itself.

Assuming that it is determined to make a horizontal incision, we proceed as follows :

Taking a firm hold close to the cornea with the fixation forceps opposite the point at which he intends to enter the knife, the surgeon plunges the broad needle or keratome straight through the cornea just inside the limbus into the iris, which is perforated about halfway between the root and the pupillary margin. The opening in the iris should only be just large enough to admit one blade of the scissors, as it is not desirable to pass the needle into the vitreous more than can be helped ; but the wound in the cornea must be large enough to admit both blades, so that a *large* broad needle is necessary for the purpose. The needle is then withdrawn, and through the corneal opening the scissors are inserted. As soon as the blades have passed through the cornea they are slightly opened and the fine blade insinuated behind the iris through the opening made in it by the needle. The scissors are then very gently passed one blade in front and the other behind the iris, right across the chamber embracing the pupil, if present, and a corresponding portion of the iris on the other side. The blades are then closed to cut all intervening structures, when the wound should form a gaping hole. The scissors are gently withdrawn and the eye tied up. If gentleness is used, there is usually no escape of vitreous. Atropine should be employed until the eye is quite quiet, and a pad and bandage should be applied for a week.

TRAUMATIC CATARACT.

The treatment of this form of cataract must depend upon the age of the patient and the course run by the case. As far as possible the treatment should be expectant and general, deferring any operative measure until it is obvious that something is really necessary. In a large number of cases, especially in those occurring in young subjects, the lens having become opaque slowly dissolve under the influence of the aqueous, and if this is seen to be going on without undue disturbance of the eye it is far better and wiser not to interfere.

On the other hand, should the lens rapidly swell up, with symptoms of glaucoma, then, if the subject is young, *i.e.*, under thirty-five years of age, an operation to break up the lens and remove as much of it as can be got away is the best procedure.

To do this a broad needle is passed into the lens through an incision just within the corneal limbus and the lens gently stirred with the point. The detached pieces will fall into the anterior chamber, and are thence removed as in an ordinary curette evacuation. It will frequently be impossible to remove more than a portion of the lens in this way at one sitting, but the glaucoma will be relieved and matters will be considerably expedited. The operation can be repeated at a later date if necessary.

In middle-aged or old people dissolution of the lens by the aqueous will only be carried out in a very partial manner, and removal of the lens by extraction will need to be performed if any sight is to be regained. The nucleus of the lens is indissoluble in the aqueous, and as the proportion of nucleus to cortex steadily and progressively increases with age, so the older the patient the less the absorption that will take place. Nor can the hard nucleus be cut into fragments capable of removal by curette evacuation, so that the only means at our disposal is to extract it as is done when removing a senile cataract.

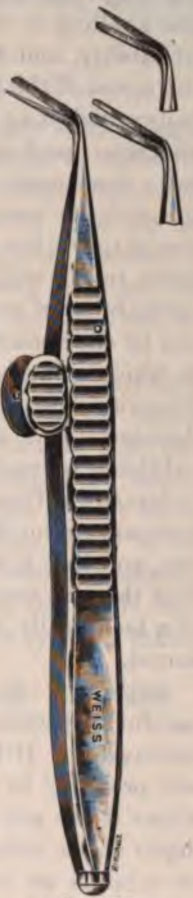

FIG. 7.—De Wecher's forceps scissors.

Should the other eye be visually good and the cataractous eye quiet down, no good purpose in many cases will be served by interfering. The case will then come into the category of monocular cataracts, the propriety of removing which has already been considered in discussing the treatment of senile cataract, and the exceptions there mentioned to the rule of leaving monocular cataracts alone will hold good in cataract of traumatic origin.

It is, of course, obvious that if glaucoma sets in, or if the eye fails to quiet down, all considerations must be subordinated to the main issue, viz., the saving of the eye, and as the presence of swollen lens may be, and often is, the main factor impeding convalescence, the only course is to remove it. On the other hand, it is not always the swelling of the lens which is solely responsible for continued irritability, and we have to bear in mind the factor introduced by the agent of the injury. The perforation of the globe by a foreign body which may not have been removed, or a wound of a lacerated character, perhaps with incarcerated iris, not infrequently complicates these cases of traumatic cataract, and is responsible in a great measure for continuous protracted inflammation. In such a case the surgeon has also to think of the risk of sympathetic ophthalmitis in the other eye, and the question to decide may not be the advisability of removing the lens, but rather whether the eye should not be enucleated. It is impossible to lay down any stringent rules to which a surgeon should be tied in complicated cases of this sort. Experience is probably the most valuable asset in coming to a right decision. The surgeon must be guided by the special features exhibited by each case, and must weigh them in the balance of his judgment. This doctrine can be laid down, viz., that nothing can compensate for the advent of sympathetic ophthalmitis in the other eye, and that it is obviously far better to lose one eye than both, so that the wise surgeon will err on the safe side if the injury has been of a technically dangerous nature, especially if the remaining eye is sound.

Supposing it is decided to extract the cataractous lens, a careful inspection should be first made to ascertain whether it is subluxated. If the lens has been shifted to any great extent, this will probably be revealed by a tremulousness of the iris at the point where it has not the support of the lens, and by an alteration in the depth of the anterior chamber, which is either uniformly deepened or exhibits an alteration in depth at one spot. In this case no attempt to deliver the lens by expression should be made, but after the usual section the lens spoon or wire loop should be passed gently behind the lens, which is lifted out of the eye. Some vitreous will probably be lost, but not necessarily so, and in any case the loss will be far less than would occur if expression were tried.

At the same time, even if the lens appear to be *in situ*, there is a much greater risk of losing vitreous in extracting traumatic cataract than is the case when removing a senile cataract, especially when the cataract is of the "concussion" type, *i.e.*, caused by a blow on the eye without any perforation of the coats, for there is always a risk that the hyaloid membrane of the vitreous has been ruptured by the same force that injured the lens, in which case the vitreous is sure to present in the wound as soon as an attempt at expression is made. Therefore in every case the surgeon must be prepared to substitute the spoon, and should commence expression with the greatest caution.

SECONDARY OR COMPLICATED CATARACT.

Very little need be said about cataracts associated with disease of other structures of the globe. In a very large number of cases the eye as a whole is so diseased that removal of the cataract, supposing that it could be safely done, would be attended by little or no improvement in vision. The danger in meddling with secondary cataracts is always great; the vitreous is always very fluid, and an attempt to extract in the usual way will almost certainly end in complete disaster.

There are two ways of dealing with these cases: (1) The lens may be couched after the old-fashioned way of dealing with senile cataract by pushing the lens with a needle backwards into the vitreous chamber; (2) A section as for the extraction of senile cataract is made, and the lens extracted with a spoon or wire loop. Of the two methods the second is, perhaps, the more likely to be successful, as being less liable to be followed by intractable inflammation of the diseased eye. Some loss of vitreous is inevitable, but it is surprising how great this loss may be and the eye still make a good recovery.

ARNOLD LAWSON.

DISEASES AND AFFECTIONS OF THE RETINA.

Inflammation of the retina is usually associated with that of the choroid, and requires the same treatment. *Syphilitic retinitis* calls for energetic treatment, which should be persevered with long after the condition has seemed to be quiet, as this condition very readily relapses. *Albuminuric retinitis* is associated with advanced disease of the kidneys, the patient seldom surviving many months. The treatment is that required for the kidneys. When albuminuric retinitis is associated with pregnancy, labour should be induced without delay. In these cases recovery may take place. *Diabetic retinitis*, associated with punctate hæmorrhages, demands the treatment for diabetes. No local treatment is of any use. The hæmorrhages persist in varying degrees, usually as long as the patient lives, which may be for many years. Limited functional use does not seem to be manifestly injurious, in which case it is hard to add to the many disabilities from which the patient is suffering by taking away the pleasure of using the eyes in moderation. *Hæmorrhagic retinitis* may be due to other general conditions, such as anæmia and arterio-capillary fibrosis. Anæmia and such conditions should, of course, be treated according to the requirements of the blood. Hæmorrhages occurring in arterio-capillary fibrosis are often provoked by some strain of mind or body, and especially by exhausting conditions of life; and absorption of the blood and recovery, more or less complete, will generally take place if the patient is careful, but he must recognise that henceforth he must take a lower standard of activity; if this be thoroughly realised, the patient may enjoy many years of useful and active life. Such patients should be cautioned against anything that tends to raise the blood pressure, such as going a long time without food and then eating a hearty meal, any sudden and violent efforts, and constipation. They should be cautioned against taking any liberties with themselves, "just this once," for their safety depends upon their leading an equable life, and one act of carelessness might land them in trouble. General nutrition should be attended to and the diet carefully regulated. Alcohol, from the point of view of the eye, is undesirable as tending to stimulate heart action, for the keynote of treatment in this trouble shou equability.

Hæmorrhages that are the result of blows upon the eye should be carefully treated, with absolute rest in bed until all trace of hæmorrhage is absorbed. Neglect of this precaution very frequently leads to detachment of the retina, which means loss of the eye so far as sight is concerned.

Detachment of the Retina.—When detachment occurs treatment is of little avail. Every now and then reattachment does take place, but so rarely, that it can be regarded only as the exception to the rule. The question that has in the first place to be decided is whether the faint hope that there is of recovery justifies the attempt to secure it, with all the tedium and loss of time that it entails. The following points have to be considered: The nature of the causative accident, the degree of detachment, the previous usefulness of the eye, the kind of life the patient leads, his age, general health, and temperament. The patients are nearly always myopic, and generally it is the least useful eye that suffers. If the patient is past middle age, the treatment is terribly trying and often positively injurious to the health. In young people it is better borne and not injurious to the health. If the life that the patient intends to lead will be an active one, such as riding, hunting, or other violent exercise, it is useless to undergo treatment, for if replacement should take place, detachment would be sure to recur. The writer generally advises patients who have one good eye to accept the loss of the other and not undergo treatment, but patients put a great value upon the sight of an eye and often insist on treatment. The only cases about which there can be no doubt are those in which both retinæ are detached.

Now, as to the manner of treatment, there are three conditions to be secured: (1) removal of the fluid from beneath the retina; (2) replacement of the retina; and (3) preservation of the position until adhesion has taken place. The first condition can be secured by limiting to the smallest possible degree the allowance of fluid, and this must be maintained during the course of treatment. Sweating by pilocarpine may be added. If these means are insufficient, the sub-retinal fluid may be tapped by passing a Graefe knife through the sclerotic in the region of the detachment and rotating it slightly, so as to allow the fluid to escape by its side. In this way the second condition is brought about. For the third condition, absolute immobility of the head between sand-bags for six weeks is required, and should replacement have taken place, then for another six weeks to consolidate it. Let there be no misunderstanding about this. The writer has known of several cases where patients have been kept flat on their back and allowed to move their head about or occasionally allowed up to recline in a chair. This sort of thing is only playing at treatment and putting the patient to a vast amount of inconvenience and discomfort for no useful purpose. He is encouraged because the vision nearly always improves as the retina settles down into its place. There is not the least difficulty in bringing that about, indeed the ordinary rest in bed at night produces it, but the factor that is required for cure is to keep it absolutely in position day in and day out. Should the patient after a week or a fortnight lift his head from the pillow, the treatment has, in effect, to be begun over again. Should replacement occur, when the patient gets about again, his movements should be always slow and deliberate. Punctures through the sclerotic and retina with needles, knives, or galvano-cautery point have been advocated in order to drain the sub-retinal space and set up some irritation that may cause inflammatory adhesion between retina and choroid, and good results have been claimed. The writer has tried all these methods frequently and has no favourable comments to make. Sub-conjunctival injections of salt and water have also been advocated. In the writer's opinion, such treatment has not even the merit of plausibility.

Tumours of the Retina, like those of the choroid, require removal of the eyeball.

Retinitis Pigmentosa slowly progresses despite all treatment. Attention to the general health is of first importance. Feeding with raw retinæ of sheep and oxen has seemed to be of value. Five sheep's retinæ or three ox's retinæ, removed fresh and rubbed up with glycerine, may be given every day.

Thrombosis of the Retinal Veins sometimes occurs, generally in gouty people. The eyes should be given functional rest; treatment for gout should be persevered in and an equable life maintained. Frequently an unexpected degree of recovery takes place, but progress is very slow while the circulation is being re-established by dilatation of existing vessels or canalisation of plugged ones.

Embolism or thrombosis of the arteria centralis retinæ or one of its branches nearly always causes blindness of the eye. Massage of the eyeball as soon as possible after its occurrence or rest in bed may be useful and should be tried.

R. W. DOYNE.

DISEASES AND AFFECTIONS OF THE OPTIC NERVE.

Optic Neuritis.—From the point of view of treatment, this is regarded rather as a symptom than disease, and the treatment must be directed to the cause that has given rise to it.

Retrobulbar Neuritis requires that the patient should be rapidly brought under the influence of mercury, and be kept at rest in bed, other nerve symptoms which may co-exist being of course treated; if the trouble has arisen from an inflammatory condition in the orbit, generally secondary to sinus trouble, this should receive prompt attention and treatment.

Optic Atrophy, the result of a previously existing optic neuritis, gives little opportunity for treatment. Possibly, the treatment with retinæ, as described for retinitis pigmentosa, may be of service, for in these cases the vessels being strangulated, the retina is starved of blood, and by surcharging the blood with the constituents required for its nutrition, some compensation may be made for the diminished blood supply. These considerations may be theoretical rather than practical, but in some cases it has seemed to do good. Strychnine and galvanism have also been recommended.

Primary Optic Atrophy associated with tabes dorsalis should be treated by a prolonged course of mercury and iodide of potassium to destroy the syphilitic virus which is nearly always responsible for this condition. Attention to the general health and nutrition is of great importance. The eyes should be protected from excessive light. The classical treatment of this disease is, or used to be, strychnine by the mouth or subcutaneous injection. In the writer's opinion, not only does strychnine do no good, but it is positively injurious. At one time he made careful observations and found in several cases marked deterioration to occur on administration of this drug. Indeed, in one or two cases deterioration was always coincident with the repetition of the administration. Some cases, though not improved, showed no particular deterioration. At the same time metaphorically flogging a wasting nerve with strychnine does not seem to be a sound principle. Galvanism has been recommended, and by some has been considered to be useful.

R. W. DOYNE.

DISEASES AND AFFECTIONS OF THE OCULAR MUSCLES.

HETEROPHORIA.

This is not a disease, and if it causes no symptoms requires no treatment. Insufficient power to overcome adverse prisms is an index of its importance.

Esophoria.—Fully correct hypermetropia or hypermetropic astigmatism. Myopia should be slightly under-corrected for distance, and if high, reading glasses should be prescribed at least 2D, and in later life 3D, weaker than a distant pair.

Employ prism training. For five minutes after each meal, for example, let the patient sit at one end of a room, with the "prism-verger" upon his face,[1] and with some very well-defined object on the wall opposite, such as a vertical strip of white paper on black velvet, or some test types. Let him start with both prisms "edge up" and rotate their apices slowly and gently outwards until diplopia commences; then rotate them somewhat back again and repeat the proceeding. Though this exercise may not remove the esophoria it will impart greater power to overcome it, so as to make it no longer embarrassing. The co-ordinating centres are strengthened.

Instead of the verger, a spectacle frame, glazed with adverse prisms, can be used, but the exercise is not so complete, since their power is a fixed quantity. Frames can be obtained with tiny thumbscrews to admit pairs of prisms of increasing strength, but to lessen expense I have submitted as a better plan to prescribe two over-strong prisms to begin with, the apices of which are turned upwards and sufficiently outwards to have the effect of weak diverging prisms. On each visit they can have their apices rotated further outwards, taking care by looking at a horizontal line on the wall or at the reflected images of a flame, that the rotations are equal, so as not to cause artificial hyperphoria.

In some cases it is a justifiable relief to the patient to wear, at least for a time, prisms with their edges inwards. They can be prescribed to correct about half the esophoria, provided that their combined strength is not greater, as a rule, than 4 degrees of deviation. They can at first, if wished, be ordered in a grab front, to be added to the ordinary correction as an experiment.

Operation is extremely satisfactory in many cases of high esophoria, if present in near as well as in distant vision. Advancement of the external rectus is best in some cases and graduated tenotomy of the internal in others.

Exophoria.—Fully correct any myopia and astigmatism, and try the effect of this for two or three months before further treatment. Young exophoric myopes should use their distance correction for reading as well. Hypermetropia should not be corrected more than the necessities of the case require.

Seek carefully for reflex inhibition of convergence. It may be caused by decayed stumps, and I have had one case treated successfully by the removal of a gland in the neck.

Prescribe a bracing change and nerve tonics, especially tincture of nux vomica or Fellow's syrup; 10 min. [U.S.P. 24 min.] of the former or 30 min. of the latter will, in the long run, do all that stronger doses can effect. Fresh air at night, with abundance of open-air exercise in the day, favours disappearance of exophoria.

Prism training, used as in esophoria, but with the edges of the prisms in the opposite direction, should be employed if the three items of treatment already described prove insufficient. Gould's method can be added as a variation. The patient wears two strong prisms, edges in, of such strength that he can do little more than fuse objects with them at reading distance; then, while the patient fixes one small object, a friend carries it further from him until diplopia commences, repeating this again and again.

Prescribe prisms, if necessary, edge outwards. The less this is done the better, since it is not a cure. For elderly people, unsuitable for training, palliation is justifiable. The prisms need not correct more than a quarter or a third of the defect, and can be combined with the lenses which correct refraction.

Operation.—As a rule, advancement of one or both internal recti is preferable to tenotomy. There are, however, a few cases in which the latter is advantageous.

Hyperphoria.—Accurately correct any error of refraction and await result for some months. If produced by former lenses sitting higher before one eye than the other, correct this.

Training prisms should only be tried if the subject has the time and patience required, and they often effect little.

Relieving prisms, edge up before the hyperphoric eye, or down before the other, or both, are far more suitable for hyperphoria than for other forms of latent deviation, and they can be allowed to correct at least two-thirds, or three-quarters, of the defect. It is well to leave a little margin uncorrected to give nature an opportunity of righting herself.

Careful tenotomy of the superior rectus of the hyperphoric eye or advancement of the other superior rectus is advantageous for hyperphoria of considerable degree if optical correction fails. Be guided by cyclophoria as described for vertical squint (*q.v.*).

Cyclophoria.—Regard low degrees as of no consequence. Correct astigmatism. In extreme cases the insertion of a rectus can be displaced upwards or downwards to correct some of the defect.

Consult Stevens' "Motor Apparatus of the Eyes," and Savage, "Ophthalmic Myology." Maddox "Ocular Muscles."[5]

NYSTAGMUS.

Enforce the constant wear of the correction for any *refractive* error.

Prescribe a *tint* in the glasses if there is any corneal nebula or lenticular opacity.

Readjust the ocular muscles in some cases, as when, for example, a squint or heterophoria is combined with increase of the nystagmus on looking to one side rather than to the other.

Miners' nystagmus requires change of occupation, preferably work in the daylight, together with nerve tonics.

Percival recommends five to ten drops of formic acid (25 per cent. solution) thrice daily (Ophthalmic Review, August, 1910).

OPHTHALMOPLEGIA.

In the early stages, to secure safety in walking about, prescribe frosted glass or a black straw cap for the lamed eye, particularly if it has been previously the master eye.

Treat the cause. When more than one nerve is affected, syphilis is extremely probable, and, whether present or not, mercury and iodides are generally appropriate, though the more chronic the condition the more attenuated should the doses of mercury be. The dose of iodide or iodoglidine depends upon the susceptibility of the patient. Perhaps 5 gr. is as good as any, unless a massive gumma is suspected.

In **Thrombotic or Hæmorrhagic Paralyses**, wet cupping of the temple is sometimes indicated in early cases; otherwise, a fly blister on the temple for intra-orbital paralyses, or on the mastoid or nape of the neck for those of intra-cranial origin. Rest, anti-gouty diet, abstinence from stimulants, and such remedies as blue pill (2 gr.) every other night, are advisable.

Treatment should be guided by urinalysis, degree of the blood pressure, signs of arterial degeneration, indigestion and, above all, constipation. For the latter, glycerine and cascara, with capsicum or ginger to draw the blood to the bowel, are suitable; also sulphate of soda or morning salines. Stooping and straining are especially to be avoided.

In **Rheumatic Paralysis**, rest in bed for the first few days may be combined with aspirin or salicylates, with hot barley-water and diaphoretics; sometimes electric heat baths. Hot sponging round the orbit is good, or antiphlogistin, changed every few hours; later, the continuous current and massage.

In **Primary Nerve Degenerations**, arsenic and phosphorus probably do most good, together with counter-irritation. Strychnine is of doubtful value other than as a temporary stimulant. Small tonic doses of mercury, say ½ gr. of grey powder, twice daily, are better.

Electricity is of but slight service for these paralyses. The continuous current may be administered by Buzzard's method,[2] through the operator's finger, clothed with damp muslin, while his hand holds one electrode, the other electrode being applied to the patient's body. From 2 to 4 milliampères suffice. The faradic current acts only by counter-irritation, since doses strong enough to make the muscles contract are painful and unsafe for the retina.

Migrainous Recurrent Paralysis imperatively requires accurate correction of refraction. A strong dose of rhubarb and bromide with caffein may be given immediately an attack threatens, combined with rest in the dark and extremely moderate diet.

Acute Nuclear Paralysis (anterior polio-encephalitis) requires anti-inflammatory and eliminative treatment, with rest and quiet in bed. In children, for example, whey diet, small doses of grey powder, rhubarb and soda.

Post-diphtheritic Paralysis needs time and patience, nerve tonics, eliminative treatment, fresh air and exercise.

Temporary relief is afforded to the cycloplegia by the use of convex lenses in a pantoscopic frame, which enable distant things to be seen with the naked eye and near objects through the glasses.

In **Paralytic Diplopia** considerable relief may often be given after the first few weeks, by prisms slightly under-correcting the defect, so as to allow room for natural improvement.

After apparent cure of a paralysis, paralytic heterophoria sometimes remains for years, and may be relieved by the wearing of prisms.

When paralysis has resisted treatment for a year or two, an *operation* can sometimes do much good. In isolated paralysis of the superior oblique, for example, tenotomy of the inferior rectus of the opposite eye will shift the field of binocular vision into a more favourable position. Paralysis of an external rectus might indicate tenotomy of the internal rectus on the sound side, together with advancement of its own tendon. Tenotomy of the inferior oblique for paralysis of the superior rectus of the other eye has been recorded by Landolt and also by Duane.

PTOSIS.

For palliative treatment fit a wire loop to the spectacle frame. the pressure of which against the lid raises it into position, Occasionally the wearing of a monocle suffices, with or without a similar wire loop.

For **Ptosis from Paralysis of the Sympathetic** remove anything pressing on that nerve if possible.

In **Neurasthenic Ptosis**, strychnine, Fellow's syrup, the relief of insomnia and antitoxæmic treatment are good, together with any remedies especially adapted to the removal of nervous debility, which is of course due to different causes in different individuals. To this may be added counter-irritation. I find capsoline suitable if care is taken to introduce none into the eye. It may be applied to the brow and temple. Electricity is used by some.

In **Morning Ptosis** the rapid alternate use of very hot and cold water to the lids may be added to the above treatment. Any auto-intoxication needs to be corrected by hepatic and gastro-intestinal regimen.

Hysterical Ptosis may be treated by faradic applications not too near to the eye or brain, blisters on the brow and temple and the use of anti-hysterical remedies. Some employ hypodermic injections of sterile water into the temple, which act by suggestion. When it affects one eye, the suggestion of Gowers to tie up the other one may be tried.

Reflex Ptosis of dental origin requires the attention of the dentist. Other sources of irritation in the region of the fifth nerve should be sought for and corrected.

Ptosis Adiposa, from drooping of the skin, should be corrected by suturing the skin to the upper margin of the tarsus, above which an elliptical portion can be removed if skin is still redundant.

Fuchs' Myopathic Ptosis, from symmetrical atrophy of the levators, requires operation, when extreme.

Congenital Ptosis can be improved by operation, the choice of which depends on the condition of the levator palpebræ and the power of vicarious elevation of the lid by means of the occipito-frontalis.

These are described in text-books, such as Casey Wood's and Czermak's works on ophthalmic operations, Berry's "Diseases of the Eye," Fuchs' "Ophthalmology," Grimsdale and Brewerton's "Ophthalmic Operations," etc. (*see also* p. 579).

STRABISMUS.

Convergent Strabismus.—Emphasise the disadvantages of delay in treatment, namely, loss of vision in the squinting eye and impairment of the fusion faculty.

Fully correct the refraction under atropine and let the lenses be worn always.

If the squint is monocular, occlude the good eye to an extent depending on the case. If the squinting eye retains nearly full vision, an hour a day will suffice. If much sight is already lost or if it is congenitally poor, continuous occlusion of the good eye for three weeks or longer is to be recommended, followed by a daily cover for from one to six hours, such as, in young children a small gauze pad held in place by adhesive plaster; with older children a light sheet of metal can be slipped over the spectacle lens or a black straw eye-cap be sewn on to the frame; or the frame can be temporarily exchanged for another containing frosted glass before the good eye. Instillation of atropine into the good eye only is a pleasanter but less efficient substitute for occlusion, the lens which corrects its hypermetropia being temporarily exchanged for plane glass. If the child still uses the atropised eye in preference to the amblyopic one, the use of a mydriatic should be abandoned. The atropine is best ordered in the form of ointment, since there is less access to the mouth and less absorption by the lacrymal passages: ℞. Ung. Atropinæ (B.P.), Cremoris Hazelini (Burroughs, Wellcome & Co.), āā ʒij. *Sig.:* A piece about the size of a barleycorn to be placed within the lower lid of the *straight* eye every night. It can be easily introduced on the end of a small glass rod while the child is asleep. Commit the directions to writing, lest the squinting eye be atropised by mistake and matters made worse.

The vision of the squinting eye should be carefully tested before, during, and after, a course of occlusion or atropinisation, since it often only improves up to a certain point, beyond which no amount of occlusion can do further good.

The better eye, after occlusion, and in the intervals, can be handicapped by various minor devices, such as over-correcting the hypermetropia of the straight eye until its distant vision is a little worse than that of the squinting eye, or by leaving its astigmatism, if considerable, uncorrected, that of the squinting eye being fully corrected. Patches, scratches, dew, tinting and other devices, can be introduced on the lens of the straight eye.

Stimulate the child's interest with the amblyopic eye during the period of occlusion. Pictures should be shown, in the details of which (finer and finer as time goes on) the child should be made to take a keen interest by such simple tales as an ingenious mother can spin. Alison Bradburne[3] uses a series of cards, on each of which letters are printed in two sizes, large and small alternating. A card is chosen on which the corrected amblyopic eye can see the large letters but not the small ones. The child is made to read with the good eye covered and uncovered alternately, the idea being that the memory of what the good eye see stimulates the vision of the poor eye.

Games of various kinds, suited to the age of the child, and especially those involving the use of card pictures, such as snap, etc., and games on figured boards, should be freely indulged in *with the amblyopic eye only.* Indeed, new toys and everything interesting for the child should be reserved for the periods during which its good eye is covered.

Education need not be wholly neglected even while occlusion continues. Arithmetic can be taught by large figures, spelling by large letters, and writing similarly, but such education should by preference be at home rather than in the classes of a school.

Stimulate the desire for working the two eyes together. Should the case be such as certainly to require operation some day, the best time for it is immediately after such a course of occlusion, that the eye may be thereby brought into a field of greater activity. Exercises in which the vision of the best eye is *gradually liberated* while the other fixes, or in which the good eye has its vision *intermittently suspended* are now in place.

Worth's[4] amblyoscope is of special service in very young children between the ages of three and five. Place the picture of a bird in one telescope and that of its cage in the other. Then taking the child upon the knee and placing its hands upon the amblyoscope, underneath your own, teach the child to make the bird appear to go in and out of its cage. Other slides containing complementary pictures should follow. To emphasise the picture before the amblyopic eye I sit on a music stool, by the rotation of the body on which the picture seen by the amblyopic eye can be moved more towards the window. The inventor, however, uses electric lamps. Let the child diverge and converge the two halves of the instrument, while engaged with the pictures and made to talk about them, the surgeon meantime gradually equalising the light before the two eyes, by slow rotation on the music stool. These lessons should be given once a week for five or six times and thereafter once a month.

Bar reading (Javal) is of but slight advantage, with older children, a series of vertical bars being placed between the child and the book it is reading, so that some letters are visible by both eyes, some by the right only, others by the left.

Excellent sets of stereoscopic exercises for older children, chiefly borrowed from Javal, are obtainable. One by Dr. Wells, of Boston, supplied by Meyrowitz, can be recommended.

Operative Treatment.—All squints refractory to treatment on the above lines should be subjected to tenotomy of the internal rectus or advancement of the external, and the sooner the better. Sub-conjunctival tenotomy is the easiest. After cleansing of the conjunctival sac, not forgetting eversion of the lid, and the instillation of cocaine (5 per cent.) with adrenalin twice, with an interval of five minutes, pick up the conjunctiva with mouse-tooth forceps, slightly below the lower edge of the tendon of the internal rectus and with straight squint scissors cut a small slit therein parallel with the tendon. Through this opening pick up Tenon's capsule and enter that in like manner. Without letting go the forceps, introduce a strabismus hook into the aperture made by the scissors and by a quick rotation pass it under the muscle and draw it forward. Now exchange the hook into the left hand and passing one point of the scissors in front of the tendon and the other behind it divide it between the hook and the globe by one or more snips. The hook may now be swept round in order to make sure that no fibres have escaped division. No suture is necessary.

Advancement of a tendon is beset with the danger of too feeble a hold if a conjunctival anchorage only is employed, or with the opposite danger of penetrating the sclera by a needle if firm anchorage therein is attempted. The following is the writer's operation: After the same preliminaries as for tenotomy, make an opening in the conjunctiva between the tendon and the cornea about a centimètre long, parallel with the limbus and about 3 millimètres therefrom, and from the centre of this another horizontal incision towards and over the insertion of the tendon. Then separate the conjunctiva from the sclera for a short distance on either side of the slit. Taking the *first suture*, armed at one end with a straight flat needle (Brooksbank James' is a good one) and at the other end with a curved oval-eyed needle, through which both free ends are threaded, pass the straight needle parallel to and near the limbus through the superficial scleral fibres for 2 or 3 millimètres, and thereafter lay both needles in a pocket of lint on the forehead. With scissors make a buttonhole in the tendon, close to the globe, after seizing the former with forceps, and extend the buttonhole upwards and downwards sub-conjunctivally so as to sever the wings of the tendon from their insertions but without disturbing the attachments of the tendon to them. Lift up the tendon with the forceps (which should never have lost their grip), so as to view its under-surface, and pass the two curved needles of a *second suture* through it from within outwards, one a little below and the other a little above its middle line, each needle emerging through the conjunctiva which overlies the tendon. Tie this suture tightly, but do not cut off the needles. Now again take the needles of the *first suture* and pass each through the tendon a trifle further back and nearer together than those of the second suture, and cut away its needles and also the tip of the tendon if the advancement is a large one. Tie this suture sufficiently tightly to produce the desired effect. Now pass the needles of the *second suture* through the dense conjunctival tissue near the cornea, one well above and the other well below its horizontal diameter and either tie them together, or, if the knot threatens to lie on the cornea, tie the upper to one of the ends of the second suture and the lower end to the other. Finally insert a fine conjunctival suture, if required, into any part of the conjunctiva that requires drawing neatly together.

The first suture secures anchorage in the sclera, and is prevented from cutting through the tendon by No. 2 suture. Its tightening secures the tendon in a horizontal position before the supplementary action of the second. It allows the scleral attachment to be made at the beginning of the operation, before the patient becomes restless.*

Divergent Strabismus.—Fully correct any myopia present, but under-correct any hypermetropia, though with full correction of any accompanying astigmatism.

If diplopia is easily elicited and the squint recent, exercise the converging faculty by the use of Priestley Smith's fusion tubes, Worth's amblyoscope, or the prism-verger. The first are the least expensive, and since divergent strabismus is most common in adults they are often suitable for the more tractable cases.

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* If the surgeon desires not to pierce the sclera, he can make the long horizontal conjunctival incision only, and pass the two (now curved) needles of the first suture through the dense tissue near the limbus away from the cornea and into the slit, and those of the second suture after tying it to the tendon, through the same slit, but in the opposite direction, to traverse similar tissue, further apart than the first. The operation in other details is the same as described in the text.

Develop diplopia and train the fusion sense when these are at fault in the same way as for convergent squint (*q.v.*).

Advance one or both internal recti if above measures prove insufficient, or if the squint is large and of long standing. In slight cases graduated tenotomy of one or both external recti may suffice, but only (and this is an extremely important point) if on making the good eye accommodate, the squinting eye performs a considerable arc of associated convergence.

Vertical Strabismus.—Correct refraction.

Precede operation by a period of occlusion of the good eye if time permits, and attempt the restoration of simultaneous vision and of the desire for fusion on the same lines as for convergent strabismus, using Priestley Smith's fusion tubes, which permit of vertical motion, as does also the Worth-Black amblyoscope.

Either tenotomise the superior rectus of the higher eye, or advance that of the lower. In deciding which of these operations to select be guided by the presence of cyclophoria and any lateral deviation. In excyclophoria and in divergence advancement of the superior rectus of the lower eye is suitable, while tenotomy of the other superior rectus is indicated by incyclophoria and by convergence.

The inferior recti are not quite so suitable for operation as the superior, but if the motor field of the higher eye is defective for downward motion it is better (*cæteris paribus*) to advance its inferior rectus.

E. E. MADDOX.

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INJURIES OF THE EYEBALL.

Non-perforating Injuries.—The results of blows upon the eye: hæmorrhage beneath the conjunctiva, into the anterior chamber, vitreous or retina, together with disturbance of the relationship of one or more of the structures within the eye.

When there is merely a sub-conjunctival hæmorrhage, no special treatment is required, but it is well to use boracic lotion (gr. 4 ad ℥j) until the parts have resumed their normal appearance. This will relieve the discomfort and quiet the alarm that may be induced. Sometimes there is deep hæmorrhage into the orbit causing proptosis of the eyeball. In acute cases ice should be placed on the eye and the patient confined to bed. The hæmorrhage usually rapidly absorbs. Treatment for damage to the conjunctival sac itself is given under the section devoted to the conjunctiva. When there is hæmorrhage into the structures of the eye and a minute ophthalmoscopic examination is not possible on account of interference with the transparency of the media, it is extremely important to keep the patient at rest in bed, for it is not possible to know that the retina has not received a concussion or sustained hæmorrhage into its tissue, causing some detachment or loosening of its connection with the choroid which may lead to ultimate detachment. As soon as an ophthalmoscopic examination is possible, the eye should be carefully examined, and if there is any hæmorrhage into its structures the patient should be kept at rest until this has been absorbed. The history of many permanent detachments of the retina can be traced to omission of this precaution. If the pupil should be at all irregular or semi-dilated, as is often found to be the case even though there has been no disturbance of the relationship of the parts, atropine drops (gr. 2 ad ℥j) should be instilled three times a day. When the patient is first allowed up, he should be cautioned against taking violent exercise for two or three weeks. Going up and down stairs, stooping to fasten boots or to pick up objects from the floor, should be done slowly and deliberately, in order to avoid momentum being given to the retina by the movement of the head, which may provoke detachment of the retina. Should there be, in addition, tearing of the structure of the iris, dislocation of the lens, or detachment of the retina, the treatment will be found under that of these structures.

When enophthalmos occurs from blows producing absorption of the orbital fat, no treatment avails and the eye will remain permanently sunken.

Perforating Injuries.—Perforating injuries, including rupture of the eyeball from blows or explosions, penetration from sharp instruments and gunshot injuries, must be treated according to the degree of damage that has resulted. Rupture of the eyeball from blows occurring, as it generally does, upwards and inwards owing to the want of bony protection downwards and outwards, is very often accompanied by extrusion of the lens, sometimes also of the iris and vitreous. Supposing the continuity of the conjunctiva has not been destroyed and there is no open wound, but the lens is extruded beneath the conjunctiva, it is not advisable at once to incise the conjunctiva for its removal, on account of the danger of sympathetic ophthalmitis that would result therefrom. It is better to allow some weeks to elapse until the wound of the eyeball itself has healed, and then the lens can be removed with greater safety. Such eyes often have excellent vision with appropriate glasses. When, however, the iris and vitreous have been also extruded and the eyeball filled with blood and no perception of light remains, the eyeball should immediately be removed. So, also, with penetrating injuries from sharp instruments, when there is complete disorganisation of the eyeball, no time should be lost in removing the eye. But if the injury has not completely disorganised the eye, an attempt should be made to save it; absolute rest in bed must be insisted on until the extent of the injury is manifest. When, however, there are partial injuries implicating the cornea, iris, or the lens, the appropriate treatment required in such conditions will be found under the headings for those structures. In all cases the conjunctival sac should be cleansed with boracic lotion and foreign bodies carefully removed. It is generally advisable to instil atropine drops (gr. 2 ad ℥j), to keep the eye at rest, and to place a pad and firm bandage over the damaged eye and, if the injury is very severe, over both eyes, for when the sound eye is moved its damaged fellow will naturally move with it. Without being unduly tight, the bandage should be sufficiently firm to prevent movement of the lids. If this is not so, the bandage will do more harm than good for the weight of the pad and bandage will merely add to the scrubbing power of the moving lid.

In *gunshot wounds* it should be remembered that the pellets are aseptic and the treatment of the wounds can be moderated accordingly. The possibility of a shot having passed through the walls of the orbit into the brain must be borne in mind, and in all cases it is well to be assured of the position of the pellet by an X-ray photograph. With the system introduced by Mackenzie Davidson an exact localisation can be readily determined. Should the shot have entered the orbit without touching the eyeball, it can be left there with safety. If, however, the eye is wounded various considerations arise. It used to be the rule to remove the eye. X-ray photography, however, has modified this, for, if the shot has passed through the eye, it is unnecessary to remove it unless chronic inflammatory trouble leading to disorganisation of the eye has been set up. The writer even goes further and would not excise an eye containing a shot unless disorganisation or chronic trouble arose in consequence of it, for among a number of cases with retained shot he has never known one of sympathetic ophthalmitis, a view supported by Mackenzie Davidson, who probably has a greater experience of this condition than any other observer.

Occasionally, small particles of hard steel from chisels and articles of that sort or bits of glass fly into the eyeball, and their presence there is sometimes not at first even suspected, the patient believing he has merely received a blow. Injuries from these causes should be examined with especial care; more gross foreign bodies, of course, manifest their presence by the resulting wound. Disorganisation of the eyeball from retained foreign bodies demands enucleation, and this course must generally be followed if the foreign body cannot be removed, to avoid sympathetic ophthalmitis, even though the eye be not disorganised. When the foreign body be iron or steel, an electric magnet may assist its removal. There are, however, exceptions to this rule.. If the foreign body is very small or is imbedded in the fundus of the eye and is difficult to reach, and has not set up more than passing irritation, and especially if sufficient time has elapsed for it to form attachment by lymph to neighbouring structures, more harm will often be done by attempting to remove it than by leaving it alone, even in the case of iron or steel with the electric magnet, though X-ray localisation makes the use of the latter a more simple matter. But, in the opinion of the writer, no foreign body of any kind should be left in the anterior half of the eyeball.

The Operation for the Enucleation of the Eyeball is thus performed.—A speculum having been introduced between the lids, the conjunctiva is seized by fixation forceps and cut with scissors closely round the corneal margin. The sub-conjunctival tissue is firmly adherent to the sclerotic close to the cornea, closing in this way Tenon's capsule. This must be raised with fixation forceps and incised with scissors before attempting to pick up the muscles. It should be done at the upper and inner part, and the incision has only been effectually performed when the white glistening sclerotic can be seen unmistakably in the wound. The strabismus hook can then be introduced, and with a clean sweep, the superior rectus be picked up, the point of the hook projecting beyond the further edge of the muscle. The scissors should then be introduced and one blade pushed by the side of the hook beneath the muscle, which should then be divided with one clean cut close to its insertion on the eyeball. This will leave a ridge at the point of the section, and, if the hook is carefully directed along this ridge, the remaining four recti will easily be found. It should be remembered that the external rectus is attached rather further back than the other muscles, but, if the ridge before mentioned is taken as a guide, there should be no difficulty in finding the muscles one after the other. It is always advisable to pick up the superior rectus first, because, if it is left to the last, the eyeball will be drawn upwards by its action and there may be some little difficulty in finding it. Finally, the hook should be swept freely round the eye, in order to to make quite sure that no fibres have been left undivided. The speculum should then be loosened and pressed backwards into the orbit, thus dislocating the eyeball, which will start forward between the lids, placing the optic nerve on the stretch. Closed scissors should then be introduced behind the eyeball and the optic nerve felt for. The blades should then be opened, and the nerve severed with one cut. The eyeball may then be held by the fingers and the oblique muscles sheared off it with scissors.

This operation is usually performed under a general anæsthetic, but for many years the writer has in nearly every case removed the eyeball under cocaine. The pain of this procedure is comparatively small, and the patients are saved the risk of the anæsthetic and all subsequent discomfort entailed by its use. Certain modifications are required when this is done. The conjunctival sac should first be rendered anæsthetic with cocaine, and then 2 min. of a 2 per cent. solution should be injected over each of the four recti muscles. The 2 per cent. solution is quite strong enough for this purpose, and entails no risk of cocaine poisoning. It is necessary to be more careful in freeing the eyeball from all adhesions and muscle attachments. No attempt should be made, however, to divide the obliques. The eyeball should not be dislocated forwards by pressure of the speculum, because that would produce exquisite pain, but it should be seized with fixation forceps by one of the stumps of the recti muscles, either the internal or the external, and held firmly while the optic nerve is felt for with the point of the scissors. Having severed it, the oblique muscles should then be rapidly sheared off, this being the most painful part of the whole procedure. After the removal of the eyeball, the sac should be washed out, preferably with some weak antiseptic lotion, and pressure applied until all free hæmorrhage has ceased. The writer does not recommend the socket to be plugged, but a pad of lint and cotton-wool should be placed outside the lids and bandaged with a large packing of cotton-wool over it. The writer has never yet found it necessary to plug the orbit. Bleeding, which is sometimes very free after excision for panophthalmitis, may be checked by douching with very hot water. When the eyeball has collapsed, frequently the case after wounds, the operation becomes a very much more troublesome one. It is difficult to find the muscles, and the strabismus hook gets caught in folds of the sclerotic in the hands of those who are not accustomed to the operation, and the eyeball, in consequence, is often removed piecemeal. If the eyeball is stuffed full with cotton-wool the procedure becomes easier, and this method may be adopted by those who are not experienced.

The operation introduced by Mules, of introducing a glass ball into the sclerotic after the retina and the vitreous have been scraped out, furnishes a better stump for fitting a glass eye and gives better movement to it. This operation is performed by excising the cornea by cutting round it just outside the limbus. The inside of the globe is then thoroughly cleansed of choroid and the retina by scraping and a ball of glass is introduced. The sclerotic is then sewn up with catgut and a drain is placed deep in Tenon's capsule at the external canthus. This is important because there is a great deal of reaction and serous exudation, to which free drainage must be given. For the glass, sometimes a celluloid or silver ball is substituted, which has the merit of not being liable to be broken by a blow. This operation is considered by some to be undesirable on account of the possible risk of sympathetic ophthalmitis, and placing the ball in Tenon's capsule has been substituted.

The loss of orbital fat that usually takes place after excision of the eyeball produces a serious cosmetic defect. It is due to some trophic interference and does not always occur, even when the eye has been removed in quite young children. It would be a great gain if it were known how this undesirable sequel could with certainty be avoided. This, however, is a problem for the future.

R. W. DOYNE.

DISEASES AND AFFECTIONS OF THE ORBIT.

Injuries of the Orbit, the result of blows from sticks and other sharp instruments, are extremely dangerous because of the proximity of the brain, with only the intervention of the papery bone of the orbital roof. Death has often resulted from wounds of which no particular notice was taken, by pens, pencils, walking-sticks, and umbrellas penetrating the brain through the orbit. Any such wound should always receive very serious consideration, until it is established that it is confined to the orbit. Such wounds often heal very rapidly. Orbital cellulitis may be set up by infection of the wound, but it is very striking how seldom this occurs in cases in which it might be expected. Wounds in this region should be thoroughly cleaned with boracic lotion, and it is important to make quite sure that no foreign body remains. Every ophthalmic surgeon of experience can tell stories of large foreign bodies, which a little care would have made manifest, that have been left for weeks undiscovered. After cleansing the wound, the eye may be tied up with a pad and bandage, but the writer prefers to leave it uncovered or protected by dark glasses, so that all discharge may readily escape.

Gunshot wounds of the orbit have been treated with those of the eyeball.

Indirect violence or falls upon the head or blows not unfrequently cause rupture of the optic nerve as it enters the orbit. Sometimes this may be only partial. Nothing can be done for the complete or partial blindness of that eye which results.

Orbital Cellulitis.—This may be set up by direct wounds, by a tiny abscess at the external canthus, often overlooked, with rupture into the orbital tissues instead of externally that sometimes takes place, by necrosis of the walls of the sinuses surrounding the orbit, or from empyema of the surrounding sinuses, especially the ethmoidal and the frontal or by a metastatic abscess and erysipelas. Sometimes a large collection of pus not truly within the orbit occurs at the brow from periostitis of the orbital edge. Diseases of the sinuses give rise to a great deal of trouble. The ethmoidal sinuses should be dealt with from the nose (*q.v.*). The frontal sinus must be opened, if it has not done so of itself, and the opening of the infundibulum into the nose must be re-established, or the procedure for obliteration of the sinus undertaken. These operations are described under conditions of the nose.

Tenonitis requires hot fomentations and anti-gout and anti-rheumatic treatment, according to the dyscrasia that may be responsible for the condition.

Orbital thrombosis should be treated by hot fomentations and evacuation of pus when it occurs, but when it is combined with thrombosis of the cavernous sinus the condition is fatal; so far as the eye is concerned, palliative treatment, such as hot fomentations, may relieve the distress of the local condition.

Tumours that are found in the orbit, arising from the bony walls, lacrymal gland, optic nerve, or other contents of the orbit, are bony, sarcomatous, dermoid, hyperplastic, or nævoid. Arterio-venous aneurysm and cysticercus also occur. Sometimes, the condition can be diagnosed by digital examination, but often an exploratory incision is needed, and in this connection congenital conditions of meningocele and the encephalocele must be borne in mind when treatment is undertaken. Sarcomata and carcinomata of course demand clearing out of the orbital contents, and if they should have grown from neighbouring sinuses should be dealt with as thoroughly as possible. Gummata require the usual treatment for syphilis, and it is usually advisable in all doubtful cases of tumour of the orbit to give a course of mercury and iodide before proceeding to operation. Bony growths must be approached with caution, for often there is far greater growth of bone into neighbouring structures than that which invades the orbit. Dermoid growths may take on active growth after adult life is reached and may suppurate. Those that very rarely occur deep in the orbit are difficult to deal with. The contents may be scraped out as completely as possible and the inside of the tumour cauterised with nitrate of silver. The small dermoid tumours, often found at the outer side of the brow, can be easily removed through small incisions. It is important, however, to get away the whole of the sac, or they may form recurring growths.

Arterio-venous aneurysms, usually the results of accidents, are troublesome to deal with. Continual pressure may cause obliteration, but often the common carotid has to be tied, and even then the aneurysm may recur by the free anastomosis that takes place. In this connection epithelioma and rodent ulcer should be mentioned. These growths attack sometimes the lid margin. Rodent ulcer, perhaps, more frequently attacks the skin near the inner canthus. These growths may be successfully treated by X-rays, and should they occur on the side of the nose by the inner canthus is may be the best means to adopt. But when they occur on e lid margin or below the lid, treatment by X-rays is inadvisable account of the puckering that results from the scar, which may splace the position of the lid. It is better, therefore, to deal th these cases by the knife. Then the position of the scar can controlled and allowance made for it when operating.

R. W. DOYNE.

DISEASES AND AFFECTIONS OF THE NOSE.

EPISTAXIS.

Bleeding from the nose is usually a symptom of local or general disease, and may occur under a large variety of conditions. From the point of view of treatment, three main causes must be distinguished: viz., hæmorrhage due to (1) constitutional diseases; (2) severe organic nasal disease; (3) rhinitis anterior sicca. Each of these must be separately considered.

(1) Epistaxis due to Constitutional Conditions.—Bleeding from the nose may occur in any of the so-called "disorders of the blood," such as severe anæmia, purpura, hæmophilia, leucocythemia; or from chronic organic diseases of the heart, lungs, or kidneys, especially such diseases as are associated with venous engorgement or high arterial tension. A severe nose bleeding may occur in the early stages of a fever, especially typhoid fever, or may be due to some temporary cause of increased blood-pressure, such as violent exercise or mental excitement. It may also be due to venous engorgement of the head, such as from pressure on the large veins of the neck.

In these conditions the bleeding may be salutary, and it is generally advisable not to arrest it unless it is excessive. In elderly plethoric men it is often beneficial, and may ward off an attack of apoplexy. It may also relieve the venous congestion associated with acute or chronic cardiac or pulmonary troubles. If the bleeding is excessive, or if for other reasons it is deemed advisable to stop it, the simplest remedies should be used in the first instance. The patient should lie down quietly, cold in the form of iced water should be applied to the nose and face, whilst the feet may be placed in hot water. The patient may also suck ice. If the bleeding continues, the nose should be carefully inspected. In the milder cases if the blood appears to be coming from the anterior part of the septum, a pledget of wool soaked in adrenalin and cocaine solution may be applied to the area, and will usually arrest the hæmorrhage temporarily. The bleeding vessels can then be sealed by a few touches with the electric cautery, which should be applied at a dull red heat. If the bleeding is profuse the best plan is to pack the nose. If available, a Howard's bag is the most convenient means. This consists essentially of a thin rubber bag, which, after being placed in position in the nose, is inflated through a tube. It is easy to introduce, very effective in arresting hæmorrhage, and easily removed, as the air can be let out before attempting to take it away. If these means are not available, the nose can be packed with gauze. The best plan is to pass the left index finger through the post-nasal space into the back of the nostril, and then to pass a long narrow strip of gauze down the nose until it meets the finger. The whole nose is then thoroughly filled with gauze by packing in successive strips, the finger in the post-nasal space preventing the gauze escaping into the throat. The gauze should not be left in the nose more than twenty-four hours. The trouble is that its removal often sets up fresh hæmorrhage, which may necessitate re-packing. After removal of the gauze the nose must be thoroughly cleansed for a few days to avoid sepsis.

(2) **Epistaxis due to Severe Organic Nasal Disease.**—In cases of serious organic disease of the nose, such as malignant growth or other tumour, or tuberculous or syphilitic ulceration, the purulent or muco-purulent discharge from the nose is often brown or red from an admixture with blood. This requires no special treatment, but occasionally profuse attacks of epistaxis occur. In these attacks the ordinary household remedies discussed above should be first adopted, and if they fail it will usually be necessary to pack the nose. Either of the methods above described may be tried, but it will be necessary to plug the nose with strips of gauze if it is found impossible to insert the Howard's bag.

(3) **Rhinitis Anterior Sicca.**—The commonest form of epistaxis is that due to anterior rhinitis sicca or the atrophic ulcer of the septum. In this affection there is a dry area of mucous membrane, usually covered with small black adherent mucous crusts, on the anterior part of the septum, usually on both sides. The mucous membrane under the crusts is excoriated or even ulcerated, and crossing the affected area are small dilated vessels. The detachment of the tiny crusts, either by picking at the nose or by forcibly blowing it, is sufficient to start the bleeding. This is usually slight in amount but frequently repeated, often daily or even two or three times a day, and though not often serious, it is a great inconvenience and should accordingly be stopped. Occasionally the mucous membrane of the septum and of the adjacent part of the floor of the nose may be excessively vascular

and bleed on the slightest touch, or it may be in a nævoid condition. The loss of blood in this condition is often serious.

Immediate Arrest of the Bleeding can always be brought about by packing the nose. It is only necessary to insert a small plug of wool or gauze a short distance into the affected nostril, and then to compress the anterior part of the nose either with the finger and thumb or by some mechanical means. In this way direct pressure is brought to bear upon the bleeding point. It is best to cover the plug of wool with oil or ointment, so that it may be easily removed. The hæmorrhage can also usually be stopped by applying a piece of wool or gauze soaked in cocaine and adrenalin.

Permanent Arrest of the Bleeding.—When the loss of blood is slight and the vessels over the affected area are not markedly dilated, the cure can usually be brought about by simply treating the dryness of the mucous membrane. The nose should be washed out daily with a simple alkaline lotion as for rhinitis sicca, and vaseline or some other weak ointment applied to the dry area. If this is well smeared over, the crusts will no longer adhere and the mucous membrane will become a dry, white scar. If the vessels are dilated or if this treatment fails, the best plan is to apply the cautery to the bleeding spots. Local anæsthesia is induced by cocaine and adrenalin, and then every bleeding spot and dilated vessel is destroyed by a few touches of the electric cautery applied at a dull red heat. Carefully done this gives rise to no pain or bleeding, and the diseased vessels are effectually obliterated. After the cautery has been used the nose should be washed out regularly twice a day and ointment applied to the affected area until complete healing has taken place. In the more severe forms of the disease the cautery may also be freely used, but if it fails it may be necessary to cut away some of the affected mucous membrane. In such cases a course of calcium lactate may be tried. It should be given in 20-gr. doses three times a day for seven to ten days at a time, then an interval of one or two weeks should be allowed before giving a second course. The combination of the cautery with calcium lactate internally may succeed where the cautery alone has failed.

H. LAMBERT LACK.

FOREIGN BODIES, MAGGOTS AND RHINOLITHS.

FOREIGN BODIES.

Patients suffering from this trouble are usually young children, who are brought to the surgeon on account of a purulent, blood-stained, offensive discharge from one nostril. If the child's head is held quite steady and a good reflected light is used, the foreign body may often be seen, usually in the inferior meatus. Frequently, however, the patient is too restless or the discharge too profuse to allow of removal under direct vision. In any case, the following procedure will be found the easiest and most frequently successful: Bend the last $\frac{1}{4}$ inch of a silver probe to a right angle. Pass the hooked end backwards along the upper part of the nose till it is well behind the foreign body. Now depress the hook and bring it sharply forward along the floor of the nose, and out at the anterior naris. In most cases the foreign body will be swept out at the same time. Sometimes the hook will slip over the surface of a smooth rounded body, such as a bead, without detaching it. If the hooked end of the probe be converted into a loop, and the manœuvre repeated, it will probably be successful.

Forcible inflation with the Politzer bag through the opposite nostril, whilst the patient swallows or cries, will occasionally succeed in blowing the foreign body out at the anterior naris.

Should the first attempt at extraction with the hook fail, or in cases where the child is so restless and intractable that nothing can be done, it is better to give a general anæsthetic at once. It may then be possible, after mopping out the nostril gently with pledgets of cotton-wool, to obtain a view of the foreign body, and to remove it, either with the hook or with nasal dressing forceps, under guidance of the eye. If, however, no view can be obtained, the safest method of procedure is to syringe out the nostril from the posterior naris.

For this purpose some 6 inches of pewter tubing should be attached to an ordinary Higginson syringe. The pewter tubing is that used for the irrigation of the maxillary antrum through a nasal opening, and is sold by instrument makers for that purpose. It can be readily bent to any shape required. The end of the tubing should be bent into a half-circle, to enable it to be passed round behind the soft palate into the posterior naris. A small piece of rubber tubing, ½ inch long, may be slipped over the end of the pewter tube to make it fit into the choanal opening better, and to guard the latter from injury by contact with the metal. During syringing the child should be turned face downwards, and a fairly forcible stream of water should be used. It is very rarely that this method fails to remove a foreign body from any part of the nasal fossa (Fig. 1).

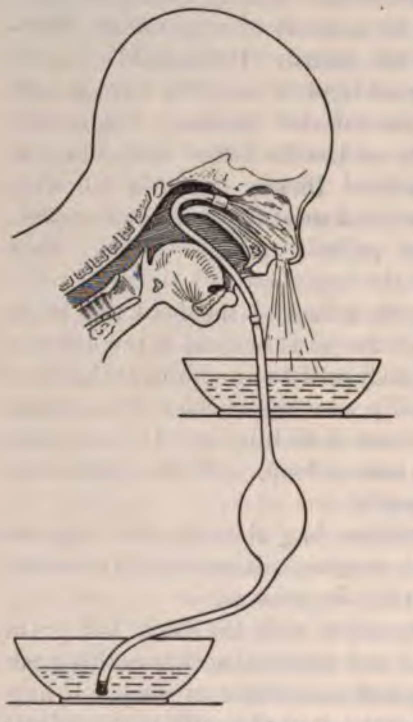

FIG. 1.—To illustrate the method of squirting out the nasal fossæ from the posterior nares.

The method of syringing through the opposite nostril, with the object of dislodging the foreign body by the return stream, should never be used. It is not only ineffectual, but highly dangerous, from the likelihood of septic matter being carried into the middle ears by way of the Eustachian tubes and setting up acute suppuration. The method above described is free from this danger. It has the further advantage of effecting a very thorough cleansing of the nasal passages, so that the discharge ceases immediately the foreign body is removed.

In adult patients the only foreign bodies commonly met with are nasal tampons, introduced by the surgeon and inadvertently allowed to remain. Occasionally particles of food, which have passed into the posterior nares during the act of vomiting, may be found. There is rarely difficulty in detecting the foreign body by inspection of the nasal fossæ after cleansing the passages and applying cocaine. They should be removed by nasal forceps, controlled by direct vision.

Such foreign bodies as bullets, knife blades, etc., may penetrate the nasal fossæ through external wounds and become lodged there. Roots of teeth may be driven up into the antrum during attempts at extraction, and may pass thence into the nose. Aberrant teeth may erupt into the nasal fossæ. The assistance of the X-rays may be necessary to locate some of these. In the case of large foreign bodies, firmly embedded, or not wholly within the field of vision by anterior rhinoscopy, Rouge's operation should be performed as a preliminary to removal.

MAGGOTS.

The larvæ of various sorts of flies are occasionally found in the nose, much less frequently, however, in this country than in America and in tropical countries. The treatment consists in killing the "maggots" with chloroform, and then removing them by syringing, by the forceps, or with a curette. If only one or two maggots are present, inhalation of chloroform may be sufficient, but for the severe and dangerous cases such as are met with in the tropics, it is necessary to employ a mixture of equal parts of chloroform and water for syringing out the nose. This procedure is intensely painful, and should be done under general chloroform anæsthesia. Spraying the nose with a 2½ per cent. solution of carbolic acid in oil relieves the smarting produced by the injection of the chloroform.

RHINOLITHS.

The treatment for rhinoliths is exactly similar to that of foreign bodies in the nose. Occasionally a rhinolith is so large that it cannot be removed entire. It can, however, usually be readily crushed with a pair of dressing forceps, and the *débris* removed with the nasal forceps.

G. WILKINSON.

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GLANDERS.

This disease is transmitted, as a rule, direct from the horse to man, and is found in those whose occupation is concerned with horses. It is due to the bacillus mallei and occurs in acute and chronic forms, the latter being the more frequent. It generally begins with swelling and redness of the interior of the nose with thin blood-stained discharge. It extends into the pharynx, infiltrating the soft and hard palates, which break down and ulcerate. It is often difficult to distinguish from tubercle and especially from syphilis of the pharynx. The acute form runs a rapid course with high fever and ends in death. The treatment is largely symptomatic, surgical interference being often necessary in the form of scraping ulcerated surfaces. Antiseptic washes are of use. Tuberculin has been tried, followed by the administration of iodide of potassium. Mercurial inunction has been found of value. Though there is a difficulty in growing the bacillus, vaccines have been tried but with very little result. All secretions from the patient should be carefully disinfected. (*See also* Vol. I., p. 221.)

D. R. PATERSON.

INJURIES AND MALFORMATIONS OF THE NOSE. (EXCLUSIVE OF THE SEPTUM.)

FRACTURES OF THE NASAL BONES.

THE commonest fracture of the nasal bone is a transverse one separating the lower third; the bone of one side only is usually broken and the fragment is much depressed, while the septum nasi is generally also fractured and displaced to the opposite side. The result is that the entire bridge of the nose appears to be deflected very markedly towards the side opposite to that of the fracture. Besides this common fracture, great violence may comminute the bridge of the nose and completely flatten it.

As these bones tend to unite with great rapidity the deformity should be corrected with as little delay as possible. It is easy to elevate the depressed fragment by manipulation with a probe within the nose, but it is often very difficult to prevent recurrence of the displacement. Packing with gauze is inadmissible, as this quickly becomes septic. The most efficient method is to cut a piece of pure rubber sheeting to such a shape (Fig. 1) as to lie along the naris and to support the fragment with its antero-superior border; the splint may be removed in ten days, and can be kept clean while in position by syringing along both its sides twice a day with warm boracic lotion. It should, of course, be boiled before introduction. The various forms of truss and external splint are useless in this class of case, for the depressed fragment must be supported from within. Comminuted fractures with much depression are best treated by transfixing the nose transversely with one or two stout steel pins; a piece of indiarubber or firm cork is pushed over both ends to exert lateral pressure, and fixed with a figure-of-eight twist of silk; the pins may be removed after five days. Any displacement of the septum must also receive attention. If the fragments are partially united in mal-position, they may be re-fractured with Walsham's dressing forceps, the

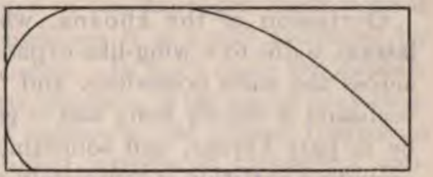
FIG. 1.—Pattern for nasal splint cut from india-rubber sheeting. (The narrow end of the splint lies in the anterior naris.)

external blade being well padded. The treatment of deformities due to old injuries is described under Malformations of the Nose (*see* p. 674).

INTRA-NASAL MALFORMATIONS.

Stenosis at the anterior nares takes the form of a band along the outer wall and floor at the junction of the vestibule with the proper nasal cavity, and may be looked on as an exaggeration of the normal plica vestibularis. More rarely a web of skin causes a complete occlusion in this situation. These webs should be destroyed with the galvano-cautery, but the tendency to recur is very persistent, and some form of dilatation must be maintained for two or three weeks. A short piece of rubber tubing, just wide enough to distend the nostril, is sometimes used, but is difficult to keep in position. It is better to employ a thick piece of rubber sheeting cut to fit the naris ; if this is boiled before introduction, and if the nose is syringed twice a day with a mild alkaline lotion introduced through a narrow nozzle on both sides of the splint, it can be kept clean without removal for the whole time required.

Occlusion of the choana, which may be uni-lateral or bi-lateral, is due to a wing-like expansion of the septum which passes across the naris posteriorly and fuses with the outer wall. The occlusion is chiefly bony and is generally very dense, but it may be in part fibrous, and sometimes presents a perforation. The occluding partition is completely cut away with chisel and mallet, together with the posterior part of the septum nasi. If this is thoroughly done there will be no tendency to the formation of adhesions and no necessity to use a splint. The septum nasi is often deflected towards the side of the occlusion, and, when this is the case, the operation of sub-mucous re-section of the septum may be advantageously combined with excision of the occlusion.

Synechiæ result from simultaneous destruction of epithelium on the inner and outer walls of the nasal passage and are most often due to operative interference, and especially to unskilful application of the cautery. If divided while they are still fresh and succulent they are very liable to re-form, and attempts to prevent this by the insertion of a strip of celluloid or rubber cause discomfort and usually end in failure. It is better to wait for some six or eight weeks until the adhesion has shrunk to a thin fibrous sheet or bridle, when simple division will generally effect a cure if the adhesion is narrow. If an extensive synechia has formed, it is necessary to remove with the adhesion so much of the turbinal that the raw surfaces cannot come into contact during the inevitable reactionary swelling.

EXTERNAL MALFORMATIONS.

These may be the result of mal-development, injury or disease, and present a great variety of forms. Only the principles of treatment can be indicated here. For the exact steps of the more elaborate operations, reference must be made to special works on operative surgery. Malformations may be considered under the headings of (1) lateral deflection ; (2) depression ; and (3) destruction of tissue.

(1) **Lateral Deflection.**—If this involves only the soft parts below the nasal bones, it may be rectified to a large extent by operative treatment directed to the accompanying deflection of the septum nasi (*see* Malformations of the Septum, p. 678).

The bridge of the nose may, however, be bent to one side. The way in which this most commonly occurs is as the result of fracture of one nasal bone through its lower third. This is accompanied by depression of the fragment and displacement of the septum towards the opposite side, so that the entire nose appears to be deflected. The prominence of the unbroken nasal bone is usually only apparent, but sometimes it is really increased by over-riding of fragments or by callus. In most cases the appearance is sufficiently restored by rectification of the septal deviation. If further treatment is deemed necessary, the broken fragments may be separated by a fine chisel introduced through a subcutaneous incision and may then be kept in position by the splint of indiarubber described under Injuries of the Nose (*see* p. 671). Or a median incision may be made down the middle of the nose with a horizontal incision at either end, and the rectangular flap thus formed turned aside to expose the bone; the periosteum should not be disturbed. This method is preferable, for the scar in this situation becomes almost invisible if the parts are carefully united. Roe has described an intra-nasal method. A tenotome is passed into the nostril, and divides the mucosa at the lower edge of the nasal bone ; it is then passed upwards in front of the nasal bones so as to elevate the skin from the bridge of the nose. A fine chisel is then passed along the track, and is used to pare off the projection of the prominent nasal bone, and the fragment so separated is pushed across to fill up the hollow on the depressed side.

(2) **Depression of the bridge** of the nose may involve only the soft parts below the nasal bones ; this is commonly the result of syphilitic destruction or abscess of the septum, and produces

a very unsightly sharp depression just below the bony ridge. Ouston's operation for this deformity consists in separating the cartilages from the nasal bones and from the nasal processes of the superior maxillæ by means of a tenotome introduced through the nostril; the instrument at the same time is carried through the septum at the lower border of the nasal bones. When the soft parts are sufficiently freed, a strong steel pin is driven transversely through the bony bridge and another through the soft parts below. These are tied together with two figure-of-eight ligatures of silk so as to hold the depressed part of the nose up to its proper level. The injection of paraffin wax achieves very good results in this deformity and is far simpler (*see* below).

Flattening of the entire nasal bridge results from comminuted fracture, syphilis, or mal-development; it is accompanied in the worst cases by an unsightly elevation of the tip of the nose, so that the nostrils look forwards rather than downwards.

Injection of paraffin wax is the most suitable treatment for the majority of these cases. The wax should have a melting-point of about 115° F. If injected in the molten state a special instrument must be employed to prevent solidification in the needle, and there is a risk of the wax spreading to the eyelids or cheeks. It is far better to inject in the solid condition with a special forcing syringe, such as Mahu's. Cylinders of sterilised wax are supplied to fit this syringe. The apparatus, after charging, is immersed in water at blood heat, and the paraffin forced to the nozzle of the needle, which is then introduced from above downwards into the subcutaneous tissue and the injection performed. A general anæsthetic is not usually required. Somewhat less paraffin should be put in than appears necessary at the time. After injection the skin becomes white and shiny if there is any tension, later some inflammatory redness appears, which soon subsides, and the puncture heals readily under a collodion dressing. The only complications arise from sepsis and from too voluminous an injection. If adhesions between the skin and the bones are present, they must be divided subcutaneously twenty-four or forty-eight hours before the injection. The method is unsuitable for cases in which the skin is extensively adherent or replaced by cicatricial tissue; it is particularly successful in the cases of flat undeveloped bridge resulting from congenital syphilis.

When the nostrils are much tilted forwards, and when there has been great destruction of the bony bridge or extensive formation of scar-tissue, a rhinoplastic operation is the only available method of treatment. In Watson Cheyne's operation [1] a median incision is made down the nose and a horizontal incision across either end of it; the two rectangular flaps thus marked out are dissected up; a straight, narrow flap is then taken from the mid-line of the forehead, including the skin, periosteum and outer table of the frontal bone, turned downwards and fixed into the tip of the nose, so as to bring it down into its proper place, and the rectangular flaps are sutured over it. Where the forehead flap is exposed to the nasal cavity its cutaneous surface is left, but it is dissected away wherever the flap comes into contact with the tissues of the nose.

Another method practised by the same surgeon is to graft a long splinter of rabbit's femur into the nose in place of the strip of frontal bone. This does not give sufficient height to the bridge, and it is necessary at a subsequent operation to insert further small splinters of bone, taking great care at this second operation not to open up the nasal cavity, or the grafting will certainly fail.

(3) Destruction of parts of the nose may involve the columna nasi, the ala, all the soft parts of the tip, or the entire external organ.

Loss of the columna sometimes results from syphilitic ulceration, and produces an ugly depression of the tip of the nose. The treatment is to cut a flap through the whole thickness of the upper lip in the middle line and turn it upwards to replace the lost columna; the gap in the lip is closed with sutures. The mucous membrane then looks outwards, but gradually becomes converted into skin; in males the skin and hair-follicles of the flap should be dissected off.

A perforation of the ala is due occasionally to syphilis, but more often to lupus; it may or may not involve the margin of the nostril. It can be closed by various plastic operations. In Langenbeck's operation a rectangular flap is cut from the opposite ala and slid across to cover the gap; the tongue of the flap lies on the bridge of the nose, and should be cut sufficiently long to allow the flap to come smoothly across. By the method of Denonvillier the flap is cut from the tissues of the same side above the defect; it has its root near the mid-line of the nose, and is slid downwards over the gap. In other cases the flap may be cut from the cheek, and either rotated over the defect or turned over so that its raw surface looks outwards, and is grafted or allowed to cicatrise.

Syme's operation is designed to replace the entire tip of the nose when the tissues of the bridge are healthy. A broad flap is fashioned in the shape of an inverted Y, with the stem over the bridge of nose, and taking the tissues from either cheek; this is folded over to form the tip and alæ of the nose, and the columna must generally be made subsequently from the lip, as already described.

When the nose is completely, or almost completely, destroyed recourse must be made to the Tagliacotian or to the Indian method of rhinoplasty. The former involves taking a graft from the tissues of the arm. The flap is fashioned and left *in situ* for a fortnight; then the remnant of the nose is pared, the flap sutured in position and the arm fixed to the face by an apparatus for ten days, and finally the attachment to the arm is severed. It is not only irksome, but extremely difficult to retain the arm motionless, failure is frequent, and the method is now seldom, if ever, employed. The Indian operation, brought by Carpue in 1814 from India, where mutilation of the nose is comparatively common, consists in replacing the organ by a flap taken from the forehead. The procedure is divided into three stages: (1) Dissection of the flap and its attachment in its new position; (2) division of the root of the flap; and (3) the formation of a new columna.

A sheet of guttapercha is moulded to the required shape of the nose, and is then softened in hot water and flattened out to form a pattern for the flap, which is traced on the forehead with iodine. The flap must be rather larger than the pattern to allow for shrinkage, and is about 3 inches long by the same width at its broadest part. It is then dissected up, rotated over the pared surface of the stump of the nose and sutured. A dressing of oiled gauze is inserted into the nasal cavity beneath the flap, and as much as possible of the incision in the forehead drawn together with quill sutures or hare-lip pins. The dressings are left undisturbed for three days, after which the intra-nasal dressing must be changed daily with great care. As the vitality of the flap improves a larger plug is used to elevate the nose, or an internal splint of moulded guttapercha may be employed.

At the end of a month the root of the flap is divided by transfixion, removing a wedge-shaped portion upwards so as to make the flap lie flat. The columna nasi is fashioned from the upper lip as before described, and this may generally be done at the same time as the division of the root. The new nose tends to become flattened, and must be supported from within the nares for several months.

Such operations demand the greatest care and attention to every detail, and are not exempt from the risk of failure. In cases, at least, it is more satisfactory to use a thoroughly made artificial nose of light metal properly painted. The rior surface should be modelled from a cast to fit accurately e patient's face, and may be supported by spectacle frames, en attached by spirit gum. It needs a strong light to detect d model of this kind, and there is the further advantage that y be used in cases where the parts are not sufficiently free disease to permit of any plastic operation.

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INJURIES AND MALFORMATIONS OF THE NASAL SEPTUM.

SYMPTOMS REQUIRING TREATMENT.

Deviations and deformities call for treatment only when they give rise to one or more of the following symptoms: (1) Nasal obstruction; (2) undue patency; (3) intra-nasal pressure. To this list one may add very marked external disfigurement, the result of severe traumatism.

(1) The general topic of nasal obstruction and its effects will not be discussed here. It may be said that in the majority of cases of nasal obstruction other than those of polypus and hypertrophy of mucous membrane, the septum is largely responsible for the defect. This is true of the cases of cramped nose in the adult which so commonly result from the neglect of adenoids in childhood, and it is essential in dealing with such cases to preserve the mucous membrane of the turbinate bodies and to restore the patency of the air-way by the removal of the less important structures of the septum, *i.e.*, the distorted bone and cartilage.

In examining all persons who complain of nasal obstruction it is important to shrink the mucous membrane of the turbinates with cocaine or adrenalin. If this is not done it is very easy to miss very large spurs and deviations which are obstructing the posterior regions of the nose. A common cause of so-called "post-nasal catarrh" is also overlooked if this precaution is not taken, that is to say, the presence of a prominent vomerine crest which, coming into apposition with the inferior turbinate, serves in conjunction with that body to roof-over a *cul-de-sac* closed anteriorly, from which stagnant secretions are never properly expelled but continually trickle back over the velum.

Deviations of the upper portions of the septum, by pressing upon the middle turbinate and thereby narrowing the hiatus semilunaris are apt, indirectly, to lead to sinus trouble, which is more often seen in the narrower of two unequal nostrils.

(2) Undue patency. In most cases of deflected septum the concavity is filled more or less by compensatory hypertrophy of the inferior turbinate. In a few cases this adjustment does not place, and the mucous membrane of the roomy nostril is dam by the unduly rapid passage of dry inspired air. The secretions

dried and retained upon the surface, and a condition of rhinitis sicca, and even one indistinguishable from true rhinitis atrophica is established. Good results are obtained by reposition of the septum if secondary infection of the sinuses has not already taken place.

(3) Intra-nasal pressure. Large vomerine crests and spurs, particularly when they surmount a deflection, may indent the inferior turbinate and even press upon and actually pierce the antro-nasal wall. Such pressure is stated to be responsible for referred pains in the upper jaw and ear, but it is not often easy to prove this connection. On the other hand, pressure between the anterior end of the middle turbinate and the septum certainly is the cause of severe recurrent pain above and below the eye, for permanent relief of the pain follows the mere removal of the pressure. Tenderness over the exits of the supra- and infra-orbital nerves is diagnostic of this septal pressure and not of sinusitis.

TREATMENT.

Recent fractures and dislocations should be dealt with at once. Under nitrous oxide anæsthesia the nasal bones should be replaced by seizing first one and then the other between the blades of Walsham's septum forceps, the outer blade of which should be sheathed in rubber-tubing to prevent damage to the skin. No force should be used, and this caution is to be observed especially if the anterior end of the perpendicular plate is displaced. The application of force to a portion of that plate not detached by fracture may result in injury to the cribriform plate. The anterior fragment of the cartilage should now be seized between the blades of septum forceps and drawn forwards, as well as rotated into the middle line. The operator should aim not merely at obtaining apposition of the broken edges of the cartilage, but at the restoration of the lower edge to its proper place in the vomerine groove, if, as is often the case, dislocation has taken place. Occasionally the parts remain in position without splinting, but as a rule splinting is required. External splinting is seldom successful, and the best plan is to insert one of Lake's solid rubber splints into each nostril, and to retain them for three weeks. The patient certainly is reduced to mouth breathing during this period, but my personal experience with various hollow metal splints is not encouraging. It is very difficult to prevent the accumulation of crusts of dried mucus within them. I have never seen septic phenomena where a rubber splint has been retained, but the precaution should be taken of injecting 5-volume peroxide of hydrogen around the splints with a pipette three times a day, and every three hours during the first two days.

One may state here that septic phenomena are never seen in the nose after aseptic operations, if peroxide of hydrogen is repeatedly injected in small quantities, and if all packing is avoided. This statement may, with very few exceptions, be considered to apply even to cases of septic sinusitis, if the operation has been completely performed.

Gauze impregnated with bismuth is stated to be free from objection on the score of sepsis, but a non-absorbent splint, such as a piece of rubber sheet, seems to be open to no objections, and is tolerated without the least pain or distress.

Deviation of the septum and the development of vomerine crests are so exceedingly common that it is only in a very small percentage that the idea of treatment need be entertained at all. Even in cases where definite nasal obstruction is present the principle referred to concerning the sacrifice of the distorted septum rather than of the tissues of the turbinates, must not be adhered to too strictly, for often a touch or two of the galvano-cautery upon the inferior turbinate, repeated every two or three years, will suffice to give a good air-way without recognisable loss of mucous membrane.

When it is evident that obstruction or pressure can be removed adequately by the ablation of a crest or spur, this should be done by a cutting operation, and not by the tedious method of electrolysis. A thin vomerine crest can be removed adequately by means of a trephine and rotary machine, but a better method creating a wound which heals at once without crust formation may be performed as follows:

Simple Crest Operation.—Cleanse the skin of the nose and of the vestibule with fullers' earth, and subsequently with biniodide of mercury and spirit (1 in 4,000). Paper all parts of the mucous membrane likely to be touched or to obstruct the view, with gauze soaked in $\frac{1}{1000}$ adrenalin and leave for 15 minutes. Rub 10 per cent. solution of cocaine with a small swab, wrung almost dry, into all parts to be touched. Repeat this three times or else inject $\frac{1}{12}$ gr. of cocaine dissolved in 30 min. of water, in two or three places about the base of the crest, carrying the needle well down to the bone or cartilage. If the injection is made at the correct level the muco-perichondrium or periosteum will be raised as a pale wheal.

With a tenotome incise the muco-perichondrium along the edge of the crest, and with a small narrow elevator detach it from the upper surface of the cartilage. The mucosa below the crest need not be preserved.

Place Goldsmith's pattern of nasal saw, which does not bind or bend, below the crest and cut upwards, or if more convenient, cut downwards from above. It is essential to watch the saw in its progress, otherwise a perforation may easily be made, or, on the other hand, a large part of the spur be left behind. On this account it is not desirable to employ nitrous oxide anæsthesia for these cases until some experience has been gained.

In sawing through a crest, a ridge of bone and of cartilage, sometimes two layers of cartilage and intervening soft tissue have to be severed, while the posterior spur probably will consist of a mass of cartilage encased in bone. It is not uncommon to see an imperfect result obtained by reason of one or other of these component parts being left unsevered. There is no necessity to apply packing after this operation. The superior flap of muco-perichondrium suffices to cover the denuded bony surface and to secure speedy healing. Peroxide of hydrogen should be run in every three hours during the first two days to prevent sepsis and also the hæmorrhage which is apt to occur when, in an hour's time, a reactionary hyperæmia replaces the adrenalin-induced ischæmia.

Gleason's Operation.—In cases of simple C-shaped deflection without much crest formation, where the septum obstructs one nostril by a single rounded convexity, a fairly good result may be obtained by Gleason's operation. Either under local or general anæsthesia the convex portion is severed by a saw cut from the rest of the septum until it hangs, as it were, by a hinge from above. This is accomplished by cutting from below upwards with a narrow (Bosworth's) saw, the instrument cutting right through all structures and entering the opposite nasal cavity. The semi-detached flap is now thrust through into the concave side, where it remains engaged without the use of splints. The operation is easy to perform, but suitable cases are rare to find. As a rule no permanent perforation results.

Moure's Operation.—Where external deviation of the tip of the nose exists, Moure's operation may give good results. The vomerine crest is first removed, and then two incisions, one parallel with the floor and the other with the bridge of the nose, are made completely through the cartilaginous part of the septum by means of strong button-hole scissors devised for the purpose. The resiliency of the strip of cartilage between the incisions is broken down with the finger, and the parts kept in the desired position for some days by means of a special metal splint, which is expanded after introduction to suit the conditions. If necessary, more than two incisions may be made. The vomer may subsequently be severed from its palatine attachment and replaced in its normal position.

Many operations have been devised upon a similar principle, namely, the destruction of the resiliency of the cartilage by incision and fracture, and the retention of the fragments in a new position by means of splints, until firm healing has taken place. In all these operations there is a considerable tendency for the deformity to return, and there can be no doubt that the results of septal surgery have been vastly improved by the introduction of the submucous resection method.

Submucous Resection.—It has for many years been the custom to remove by submucous resection portions of the dislocated anterior end of the quadrilateral cartilage which project into and obstruct the nasal vestibule.

The complete removal of the whole of the distorted bone and cartilage without the loss of mucous membrane was devised independently by Freer and by Killian. By Freer's method the whole of the distorted portions are laid bare upon one side by reflecting the freely incised mucous membrane.

By Killian's method the distorted portions are removed through a single linear incision made near the anterior end of the septum. In a typical case of developmental deflection a perfect result may be obtained by Killian's method in some fifteen minutes without any necessity for stitching, and with the certainty of immediate healing and the avoidance of all after-treatment. This method will therefore be described, as applied to a typical case of purely developmental origin. The reader is emphatically urged not to attempt to deal with traumatic cases by this method until he has done at least a dozen developmental cases successfully. It is taken for granted that he is a skilful surgeon, and already used to manipulation of the deeper parts of the nose under illumination by the forehead mirror or head-lamp. The operation may prove to be one of considerable magnitude and difficulty, and should, therefore, not be undertaken unless the surgeon is confident of his ability to remove the posterior as well as the anterior source of obstruction, for if the easy anterior obstruction alone is removed the subject of a typical sigmoid deflection will receive but small benefit.

The operation field must be rendered bloodless by adrenalin ischæmia, and either local or general anæsthesia may be employed. Until experience is gained the surgeon is advised to adopt a light chloroform anæsthesia and the sitting posture.

The skin is prepared as above, and no antiseptics should be applied to the mucous membrane. Half an hour before operation the septum is papered with gauze-strip wrung out of $\frac{1}{1000}$ adrenalin. The effect is less marked and much less rapid than that afforded by injection, but I have seen in athletic subjects a very sudden general vascular contraction and cardiac embarrassment follow the submucous injection of adrenalin solution; on the other hand, it is extremely rare not to get a satisfactory ischæmia with the simple application of the drug if it is kept in apposition for half an hour.

If local anæsthesia is employed, the injection fluid should be weak and fairly copious, and must always be injected below the muco-perichondrium and periosteum.

The distorted parts have to be removed through a single incision about 1 inch in length and vertical in direction, made well in front of the anterior limits of the deformity. As a rule the incision should be made on the convex side, and should be carried right through the cartilage as well as one layer of mucous membrane.

The point of the knife should be made to penetrate the cartilage until it is seen to pucker the mucous membrane of the concave side. The point can now be watched travelling under the intact mucous membrane as the blade is carried down carefully, severing the cartilage and the mucosa of the convex side as it descends. The septum is then thrust towards the convex side until the cut edge of the cartilage is seen standing out white in the wound. It is now perfectly easy to elevate the muco-perichondrium on either side from the cartilage. At the extreme anterior limits of the septum the perichondrium is closely adherent and may need elevation with a fairly sharp instrument, but there should be no mistake in detecting the proper position for the insertion of the elevator. A mistake commonly made is to split the mucosa from the perichondrium, with great loss of time and with imperfect results.

All distorted portions with the exception of a slip at least ⅓ inch broad below the bridge is stripped, then engaged between the long blades of St. Clair Thomson's modification of Thudicum's speculum, and removed with a sweep of the swivel-knife. This valuable instrument, devised by Ballenger, consists of a small knife-edge slung between the two prongs of a fork. By its means a piece of cartilage 1½ inches in length and 1 inch broad can be removed in a few seconds. In peeling the cartilage special care should be taken not to drive the elevator through the exceedingly thin tissues of the salient area of the deflection; this error, which causes confusion and delay, may be avoided by straightening the cartilage with the finger or speculum as the peeling proceeds.

The cartilage having been removed, those portions of the perpendicular plate which are out of the middle line will be clipped away with a sharp punch-forceps (*e.g.*, Hartman's conchotome, small size), and on no account wrenched with blunt instruments.

A sharp gouge, ground square or "fish tail," is applied to the anterior attachment of the vomer, which is cut through with two or three strokes of the mallet. The upper edge of the vomer is now carefully cut through with the conchotome behind the point, generally in its posterior third, where the prominent spur or posterior deflection is situated. The blades of Adams's or Walsham's septum forceps are inserted on either side of the vomer still covered by intact mucous membrane, and with a few turns of the wrist the bone is cracked off at the vomero-palatine articulation. With care this can be done without damage to the mucosa. The vomer will now be found lying in the wound attached at a few points only to the periosteum, and will be easily removed with forceps after making a few strokes with the elevator. A prolonged dissection of the vomerine periosteum is neither necessary nor desirable, and if occasionally the method described produces rents upon the prominent edge of a crest, a corresponding rent upon the opposite side is not likely to occur and no perforation results. It goes without saying that the vomerine fragment must not be dragged from the wound before it is properly freed.

The removal of bone and cartilage is carried on until the middle line has been reached at all points, with the exception at times of the slip left to maintain the contour of the nose. No stitching and no antiseptic sponging or douching of the wound are required. In order to prevent accumulation of blood-clot between the two layers of mucous membrane, a splint made of rubber-sheet from $\frac{1}{10}$ to $\frac{1}{6}$ inch thick is inserted into either nostril and allowed to remain for twenty-four hours. As a precaution 5-volume peroxide may be injected every three hours for the first two days, at the end of which time healing will be complete if no tearing has occurred.

The typical easy case of an adult developmental deflection has been described. In experienced hands the operation should occupy about fifteen minutes. In young persons the elevation of the muco-perichondrium may be difficult, and injection of saline may be employed before incision to aid in the detachment. The vomer in young persons is flexible and often cannot be cracked off at the vomero-palatine articulation. Careful dissection may then be necessary, and the removal of the vomer carried out piecemeal with punch forceps. The operation in a young person may, therefore, be a prolonged one, and the chances of tearing the mucous membrane upon both sides, and so creating a perforation, are a good deal increased. Perforation in the posterior region of the septum is of little consequence; but when the anterior third is involved, crust-formation may give trouble for months. Special needles have been devised for the suture of rents made during operation, but a ½-inch straight needle, threaded with horsehair, will serve well if it is carried eye foremost into the nostril with a pair of sinus-forceps, the suture being made from behind forwards.

It is of the utmost importance to leave the supporting strip of cartilage under the bridge of the nose, and where growing subjects are concerned to remove a minimum of cartilage. The typical extensive operation described above is inapplicable to children, and, indeed, to any patient who has not already approached full development.

The operation, if done at all, must be done completely, and for this reason. If the two nostrils are not rendered equally patent there will exist during respiration such a degree of pneumatic inequality that the now flexible septum will sway with each breath, and occasionally rhythmical sensations, as a consequence, will be experienced in the upper incisor teeth. For instance, if the anterior orifice of the left side is allowed to remain smaller than the right, at each inspiration the flexible septum will bulge into the left nostril. The proper means of avoiding this trouble is to equalise the two nostrils at the time of operation. It may also be avoided by re-inserting the segment of cartilage removed with the swivel knife, but this course is not unattended with serious risks on the score of sepsis.

In cases of traumatic origin the submucous operation is performed as described above; but the detachment of the perichondrium from the fragments of the cartilage may be tedious and difficult, and instead of fifteen minutes a full hour may be occupied if a good result is to be obtained. It is, therefore, often a question in such cases whether its place should not be taken by one of the simpler operations, such as that of Moure or Gleason, or the mere destruction of the resiliency of the cartilage by multiple incision and subsequent splinting.

The submucous operation gives better immediate and permanent results than the less extensive operations, and is much more likely than any other to enable the patient to forget that he has been the subject of nasal symptoms.

The need of these operations would be greatly diminished if all traumatic cases were treated at the time of the injury, and if during the years corresponding with the eruption of the permanent teeth the causes of mouth-breathing were removed. Indeed, even when developmental deflection has commenced to make its appearance further progress sometimes may be prevented by careful attention on the part of the dental surgeon to the artificial moulding of the alveolar arch.

E. B. WAGGETT.

LUPUS AND TUBERCULOSIS OF THE NARES.

The lesions of lupus are very common in the nares in cases of cutaneous lupus, or when the disease has attacked the fauces or larynx, but they frequently escape observation as they cause no symptoms in any early stage. Christiansen[1] found the nose affected in three-quarters of his cases of lupus. In rhinological practice the disease is not infrequently found limited to the nares. Escat[2] has enunciated an important theory, which has much to recommend it, to the effect that tubercle bacilli which enter the nares find there an unfavourable environment, and become attenuated and so able only to produce the modified lesions known as lupus, which, therefore, originates within the nose and thence spreads outwards to the skin or backwards to the palate and larynx. In any case it is obviously of the highest importance to eradicate the disease within the nares in order to prevent re-infection in all cases of cutaneous lupus. The lesions take the form of nodular deposit, ulceration and larger masses called "tuberculomata," which tend to break down and become indistinguishable from the ulcerative form. They attack principally the anterior portions of the nares, especially the septum, within reach of inoculation by the finger, but spread to other parts, especially the nasal floor and inferior turbinal.

Local Treatment.—In the first instance, unless the disease is very limited, a general anæsthetic should be given. The nares are packed beforehand with wool soaked in 1 in 1,000 adrenalin solution, for this blanches the normal mucous membrane and makes the typical brownish-red coloration of the infiltrated tissues stand out clearly, and thus defines the extent of the disease. All the affected tissue is then carefully and thoroughly removed with a sharp spoon. A localised infiltration on the anterior end of the inferior or middle turbinal may well be dealt with by excision with scissors and snare of the affected part. A chemical caustic is then thoroughly rubbed in, after drying the nares to prevent the caustic running on to the healthy parts. Lactic acid is the best for the purpose, and may be used in concentrations of from 50 per cent. to the full pharmacopœial strength, or a mixture containing lactic acid 50 per cent., formalin 7 per cent., and phenol 10 per cent., may be employed. Dryness and crusting are troublesome during healing, but may be largely prevented by the instillation of oily drops, such as: Unguenti hydrargyri nitratis, ʒj; olei olivæ, ℥ss; paraffinum liquidum, ad ℥j. The nose should be very carefully examined again after the application of adrenalin in three weeks' time, and any recurrences destroyed under local anæsthesia with the curette or with the galvano-cautery. Very small lesions may be treated in this way from the beginning under local anæsthesia. It is an easy matter to get great improvement, but difficult to eradicate the disease in such an irregular cavity as the nose. Patients should be seen at intervals of three months until the nose has been free from recurrence for at least a year.

General Treatment is of great importance. An open-air *régime* should be ordered, and many cases do best in a sanatorium. Ample feeding and cod-liver oil are of value, and the writer thinks highly of arsenic, which should be given in fairly large doses, beginning with 5 min. of liquor arsenicalis [U.S.P. liquor potassii arsenitis] three times a day, and increasing the dose by 1 min. each day until 15 min. are reached, when it may be continued unchanged. If toxic symptoms occur, the administration is discontinued for a week, and then resumed with the dose which was being taken when the symptoms occurred. Tuberculin appears to do good in lupus of the mucous membranes, but the dose should never be large enough to cause marked local reaction; $\frac{1}{25000}$ milligramme of tuberculin is sufficient for the first injection. The dose may be gradually increased. Care as to the dosage and spacing of doses is most necessary (*see* Tuberculin Therapy, p. 291). The application of radium, Finsen light, or Röntgen rays is hardly possible within the cavity of the nares, whereas surgical methods are particularly successful here, for they are not handicapped, as in cutaneous lupus, with the fear of producing unsightly scars.

Tuberculosis of the Nares.—The nose is, of all parts of the upper air-passages, the most resistant to tuberculosis, as distinguished from lupus. In patients who have died of pulmonary tuberculosis only some 2 per cent. show lesions of tuberculosis within the nose. These secondary infections usually take the form of ulceration far back in the nares, and therefore usually pass unrecognised during life. The lesions most commonly produced in the nose by the tubercle bacillus are evidently due to infection through the nostril, and affect the anterior part of the nares. They are primary in the majority of cases, chronic in their course, and are clinically indistinguishable from lupus, under which heading their treatment is discussed.

HAROLD BARWELL.

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[1] Journal of Laryngology, 1903, Vol. XVIII., p. 50.
[2] Annales des Maladies de l'Oreille, October, 1905.

NASAL NEUROSES.

PAROXYSMAL OR VASOMOTOR RHINORRHŒA.

Paroxysmal or Vasomotor Rhinorrhœa occurs in persons of all ages, of both sexes, and chiefly among the upper classes; many of them show other signs of instability of the nervous system, and there is frequently a neuropathic family history. The patients complain of violent attacks of sneezing with profuse watery discharge, headache and nasal obstruction; the attacks usually come on in the morning frequently on the first contact of the skin with the cold air. Other patients have rhinorrhœa at all times without sneezing, and others suffer from the rapid onset of nasal obstruction on any change of atmosphere. The patients are usually not in robust health, and the prolonged attacks of sneezing are most exhausting. Any gross nasal abnormality is exceptional in other cases, but the mucosa usually has a pale and "waterlogged" appearance.

Treatment.—General treatment consists in the administration of tonics and avoidance of the worry, overwork or sexual excess which is often a strongly predisposing cause. The administration of calcium lactate has been advised on account of its beneficial effect on the somewhat similar condition of urticaria, but the writer cannot convince himself of any benefit in the cases where he has tried it. The combination of atropine with strychnine sometimes does good: ℞. Liq. Atropin. Sulph. ♏ $\frac{1}{2}$; Liq. Strychn. ♏ 5 [U.S.P. Atropin. Sulph., gr. $\frac{1}{220}$; Strychn. Hydrochlor., gr. $\frac{1}{22}$]; for a dose, once a day for a fortnight and then twice daily for a further fortnight; the course to be repeated after a few weeks' interval. Of local treatment, any real source of irritation should be removed; a movable pedunculated polypus, or a septal spur impinging on the outer wall, may be such a source, the removal of which may cure the affection. But it cannot be too strongly stated that nasal operations should not be performed in these cases unless some very definite abnormality be present, that such abnormalities are rare, and that even when present, cure after their removal is far from certain. When the nasal mucosa is very hypersensitive, the most soothing application only increases the discomfort; cocaine and adrenalin have a very transitory effect and are followed by a severe reaction, indeed, the application of these drugs will induce an attack of rhinorrhœa in susceptible patients during a quiescent period. Anæsthesin has a local sedative action which is free from this drawback, and the following cream is a useful application:—℞. Anæsthesin, gr. 40; Menthol, gr. 5;

Paraffin. Liq., ʒv; Paraffin. Moll. Alb., ʒiij. The extreme anterior part of the septum is often hyperæsthetic in these cases, and much good may result from dulling of the sensibility by *light* cauterization of these areas; the result is too often only temporary but may be repeated with advantage. Finally, it may be repeated that the result of treatment is extremely variable, that some cases improve rapidly while others are extremely intractable, and that a confident prognosis is apt to end in loss of credit.

HAY FEVER.

Hay fever is a very similar affection, in which in addition there is an actual source of irritation in the form of a toxin existing in the pollen of certain grasses and flowering plants. A special susceptibility is present in these cases, for a highly dilute solution of pollen extract produces conjunctivitis when applied to the eye of a hay-fever patient, whereas a strong solution fails to cause any reaction in a normal individual.

Treatment.—Treatment directed to the general health is of little value except inasmuch as a patient in good health is better able to withstand his annual affliction. When possible, residence in a locality relatively free from pollen should be advised; some patients keep well at the sea-side, whereas others can only find relief on board ship. Gross nasal abnormalities should be removed, and patients are less distresed by their attacks if they have naturally patent nasal passages. The cauterization of sensitive areas in the nose is frequently of great benefit; it is not a cure, but it does usually greatly lessen the severity of the attack, and it is worth while for most patients to have the nose cauterized every year a month before the onset of the hay-fever season. Dunbar has produced an antitoxin by inoculating horses with pollen extract; it is named Pollantin (*see* Special Article, Vol. III.), and is applied frequently during the season to the conjunctiva and nose with considerable benefit in many cases. A dry and a liquid form are prepared and both should be tried. Recently an attempt has been made to produce active immunity by injection of minute increasing doses of the pollen extract; and this increases the resistance to the toxin, as tested by the conjunctival reaction to the solution of pollen. The results in last summer's season were promising, but it is still too early to say more (*see* also Vaccine Therapy, Vol. III.).[1]

SPASMODIC ASTHMA.

The relationship between asthma and the nose is an extremely difficult subject; this, however, may be said, that in certain predisposed persons afferent impulses from the nerve-terminations in the nose can determine an attack of asthma, and that in some cases intranasal treatment has the effect of curing or modifying the disease.

Intranasal Treatment.—On examining the nose of an asthmatic various conditions may be found—nasal obstruction, a definite source of irritation, polypi, or a normal nose.

Nasal obstruction is certainly disproportionately common in asthmatic subjects; if marked obstruction is present, an operation for its removal should be undertaken, for in some cases this will cure or distinctly improve the asthma, and in all cases the attacks of asthma are rendered more tolerable if the nasal passages are free from obstruction.

Sources of Irritation are present in some cases; the most definite of these is a sharp septal spur impinging on the outer wall of the nose, and this is probably the most hopeful form of nasal abnormality to find in an asthmatic patient, for there is a fair chance that its removal will have a very favourable influence on the attacks.

Polypi.—Asthma is not uncommon among patients suffering from nasal polypi and their removal often improves the asthma; but it is unwise to be over-sanguine in these cases for the affection is sometimes made worse and the writer has twice, by the removal of polypi, given asthma to patients who had never previously had the affection; this was probably due to exposing parts of the nasal mucosa long protected to the irritation of the air current, as both cases lasted only for a few weeks.

Normal nares are, however, the rule in the majority of asthmatic patients. Sometimes, in such cases, excellent results are obtained by superficial cauterization of part of the nasal lining. The best place is usually a spot on the septum opposite the anterior end of the middle turbinal body. The writer has done this during an attack with immediate relief of symptoms, and many cases are quickly improved, while others, more intractable, are nevertheless benefited by repeated cauterization on alternate sides at weekly intervals.

In conclusion, it must be remembered that the results of intranasal treatment in any individual case are most uncertain, that many cases improve for a time after operative interference but relapse later, that general treatment must never be neglected and that some cases depend rather on disturbances of the digestive organs than of the upper respiratory tract.

HAROLD BARWELL.

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NEW GROWTHS OF THE NASAL CAVITIES.

New growths of the nose occur in benign and malignant forms. The benign tumours occurring are papillomata, fibromata, angiomata, adenomata, lipomata, enchondromata and osteomata. The latter do not include cartilaginous and bony spurs of the septum which are not true tumours, but hypertrophies. Polypi also are not true tumours, and are considered elsewhere. The malignant tumours are carcinomata, sarcomata and the mixed type, endotheliomata; the degree of malignancy varying slightly in the order given, the carcinomata being usually the most rapid and aggressive in their progress. While this variation may be borne in mind as bearing upon whether curative or palliative measures are advisable, those measures are carried out in precisely the same way in all three varieties. The treatment of both benign and malignant tumours is essentially surgical. As yet, no therapy has proved curative, though the future is full of promise. The chemical cautery is objectionable for many reasons, chief of which is the impossibility of controlling and limiting its action to the desired area. For all intranasal procedures a good speculum and good illumination by the head-mirror or the electric head-light are absolutely essential. Blind groping is absolutely unjustifiable.

THE EXTIRPATION OF BENIGN GROWTHS.

For all small growths arising from the mucosa, cocaine analgesia is perfectly satisfactory. The tumour itself usually has but little sensibility, but the entire interior of the involved nasal fossa must be rendered insensitive to permit of unhampered instrumentation. This is done by packing the entire cavity with pledgets of cotton saturated with a 4 per cent. solution of cocaine hydrochloride to which an equal quantity of a 1 in 1,000 solution of adrenalin chloride has been added. The pledgets should be squeezed to remove the surplus solution. They are inserted with small forceps. After the cotton packing has been in place for five minutes the anæsthesia will be complete and the pledgets may be removed with the small forceps. In tumours involving the muco-cutaneous margin it will be necessary to inject a small quantity of the solution mentioned into the integument, remembering that the injection must be intradermatic, not hypodermatic. The analgesic effect of this is immediate and operation may at once be proceeded with. If the removal contemplated is somewhat extensive, $\frac{1}{4}$ gr. (gramme ·016) dose of morphine hyperdermatically with $\frac{1}{100}$ gr. (gramme ·00065) of atropine will forestall syncope and increase the patient's tolerance and also will be antidotal to the toxic effects of the cocaine. The removal of the tumour in most cases may be readily done with one of the many forms of biting forceps (Fig. 1), used under the guidance of the eye, with good illumination, the field being swabbed clear of blood from time to time with wisps of absorbent cotton wound upon small applicators. In cases of small growths upon the septum a small long-handled nasal operating knife will be a more accurate instrument than the forceps. Except in cases of angiomata and fibromata, hæmorrhage is usually slight, and is checked by packing the nasal chamber full of long strips of sterile lint into which sterilized bismuth subnitrate has been dusted. The strips should be about a centimètre or less in width and they should be laid with a large probe in layers, the first layer being laid full length, from anterior naris to choana, upon the floor, the next also full length upon this, and so on until the nasal chamber, and especially the posterior naris, is filled as completely as possible. The object is completely to fill the choana with a plug composed of only the posterior folded ends of layers that extend forward to the anterior naris, so that they may not slip downward over the velum, as they are apt to do when the nose is packed with small tampons after the manner of a vaginal tamponnade, or when the nasal cavity is indiscriminately stuffed full of any kind of packing material. When a packing slips backward over the velum, screatus and retching soon excite hæmorrhage, and an unpacking and repacking are necessary. The packing is removed forty-eight hours after the operation,

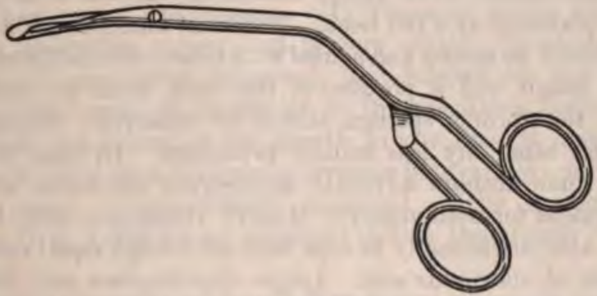

FIG. 1.—Lack's nasal biting forceps.

beginning with the upper layer, and the nose is insufflated daily, until healed, with thymol iodide. Packing is to be avoided in case of accessory sinus disease. Many operators use some form of nasal snare very successfully in the extirpation of benign growths. When the growth is prominently located, as upon a turbinal, it is feasible to remove a sufficiency of normal basic tissue; but when upon a more or less planic location, such deep removal is impossible, and it is wise to follow the snaring procedure with a thorough galvano-caustic application to the stump. This should be done after any method of extirpation, if there is any doubt as to the thoroughness of removal. In case of angiomata, some operators use the galvano-caustic snare; others prefer to do the entire operation with the galvano-caustic knife alone, dissecting out the entire growth with the platinum at a red heat. In case of fibromata, if a snare is used it should be strong and armed with heavy wire as these growths are very tough, and a portion of the bone, from the periosteum of which the fibroma springs, should be removed. Repullulation is common after any less radical procedure. In case of a large fibroma, some authors advocate an external operation similar to those required for malignancy. Modern rhinologic skill, however, has been able intranasally to cope with all benign nasal neoplasms, even when of enormous size. Large chondromata and osteomata are an exception to this, though small ones may be removed intranasally with chisel, gouge, mallet, saw and rongeur. In cystic and teratomatous conditions the general surgical rule of complete extirpation of the sac must be followed, else recurrence will be probable. Occasionally fibromata and angiomata bleed rather profusely, in which case it is essential rapidly to remove all of the growth in order to have room to pack properly. Very rarely anterior and posterior plugging may be necessary with those insufficiently skilled in the art of packing. No matter how certain we may be of our diagnosis of benignancy, it is always wise to have a microscopic examination of the growth made after removal, especially of that portion which includes the junction of the neoplastic tissue with the normal. Should this lead to suspicion of malignancy, it is urgently necessary immediately to re-operate and remove a very wide and deep area of normal tissue from the site of the growth. It is a grave error under these circumstances to delay re-operation until recurrence has taken place.

MALIGNANT GROWTHS.

In deciding upon the plan of treatment it is absolutely essential to determine at the outset whether the case in hand is operable or inoperable, in other words, whether the case is one for curative or palliative treatment. When we say "operable," we do not mean only that an operation can be done without mortality from immediate surgical risks; but we limit the word strictly to those cases in which an operation offers a fair hope of the patient remaining free from recurrence for one year. Reappearance long after one year may be properly considered reinfection, rather than repullulation of the primary process, and a relative cure of one year's duration justifies the operation. Incomplete removal is certain to stimulate growth and is utterly unjustifiable, except as a palliative measure where extension to mouth or pharynx threatens asphyxia or inanition.

Curative Treatment at the present day refers only to *operable cases.* These are of two classes: (1) Those in which the growth is in any accessible region, but is very small; (2) those which, even though somewhat advanced, are located in the anterior portion of the nasal chambers or in the maxillary antrum. In determining the extent of the growth in any case, it must always be borne in mind that malignant invasion is invariably much more extensive than is superficially apparent. The application of adrenalin (1 in 2,000 watery solution) defines the growth (St. Clair Thomson).

Malignant Growths of Small Size in any accessible region may be removed under local anæsthesia, through natural passages, as described for benign growths, except that in dealing with malignancy, very much wider and deeper removal of apparently normal tissues is necessary. If such wide removal is not feasible intranasally, an external operation is required, and unfortunately almost all intranasal malignancy is unobserved until it falls in this category. The entire ethmoidal cellular mass can be removed entire with Ballenger's ethmoidal knife. Hæmorrhage is usually slight after removal of the small growths, for which alone intranasal methods are advisable, and it is readily controlled by packing as previously described.

Malignant Growths Located Anteriorly in the Nose that are operable, though too far advanced for intranasal methods of removal, may be removed by one of several methods of external operation. These involve the making of a preliminary osteo-plastic flap of the soft tissues and the nose. This flap is drawn upward, downward or laterally to give a large exposure of the field of operation. General anæsthesia is necessary, and if the operation is to extend into the mouth a preliminary tracheotomy for anæsthesia permits a tamponnade of the pharynx to prevent the flow of blood into the larynx and trachea. If the roof of the mouth is not to be opened a naso-pharyngeal plug will prevent blood entering the pharynx. In the writer's experience the most satisfactory operation has been found to be the splitting of the external nose, soft tissues and bone, down the median line from the brow to the tip. The two lateral flaps then held aside, give the largest field possible, with the minimum of subsequent deformity. The growth can then be freely removed, including the underlying bone or cartilage, even when located in the acute angle formed by the junction of the septum with the lateral walls of the nasal cavities. The edges of the nasal bones are accurately approximated, and the skin of the nose is united by the subcuticular horsehair suture. This operation results in surprisingly little deformity. One patient, from whom the writer removed an endothelioma, is alive and well ten years after a second operation.

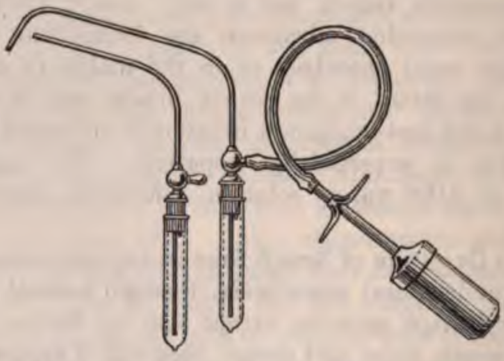

FIG. 2.—Atomizer for spraying all of a very small quantity of solution, thus facilitating accurate dosage of anodynes applied to the nose and throat for inoperable malignancy.

In Ollier's operation, the flap is single and is made of inverted **U**-shape, the inverted base being at the junction of the eyebrows, from which one branch extends down each side of the external nose, the whole of which is laid down as an osteo-plastic flap. In Rouge's operation, the osteo-plastic flap, including the external nose, is thrown upward. No skin incision is made. The mucosa is incised at the labiogingival junction all round the alveolus from one anterior molar to the other, the septum being divided vertically as the flap is turned upward.

Malignant Growths of the Maxillary Antrum are curable by radical operation only when discovered early while the growth is limited to the bony box. The removal of the bony box, that is, the exsection of the superior maxilla, takes with it the whole growth. The preliminary ligation of the external carotid artery lessens shock. Better still is the temporary compression of the common carotid artery as advocated by G. W. Crile. Sir H. T. Butlin, after extensive personal experience and collective investigation, did not regard favourably operations for nasal malignancy. The surgical risks are those of exhaustion, sepsis and pulmonary complications. The percentage of recurrence is high, except in very early cases.

Palliative Treatment is all that can be offered those cases of nasal malignancy in which the disease, whatever its location, is far advanced, or in which, even though small, it springs from the ethmoidal, sphenoidal or frontal sinuses, or from the posterior portion of the nose. The most distressing symptoms for which we must provide relief are fœtor, local pain, general headache, exhaustion, and as the growth invades the pharynx, dyspnœa and dysphagia. Fœtor is due to the mixed infections and saprophytes. It is best combated by cleansings with cotton pledgets moistened with a solution of hydrogen peroxide. This is followed by an alkaline spray, such as sodium bicarbonate and sodium biborate, of each 3 gr. (gramme ·190), with 1 gr. (gramme ·065) of carbolic acid to the ounce of water. In advanced cases, where the growth has obstructed the outlets of the sinuses without filling their cavities, the liberated gas may cause intense pain by being pent up in the sinuses. In such cases the alkaline spray may be used alone. Formaldehyde solution (1 in 3,000) is a highly efficient spray, but irritating. Creolin in 1 per cent. watery solution is an excellent deodorant. If there is little tendency to bleed the nose may be wiped out with wisps of cotton wound on thin wire applicators. The cleaner the nose is kept the less will be the fœtor. A well-trained nurse can control the odour if the nose can be cleansed with a swab without exciting bleeding. Local pain in hopeless cases is best controlled by a nasal spray of morphine in ¼-gr. (gramme ·016) doses. The best method of administration is by an atomizer that will spray all of a very small quantity of solution (Fig. 2), thus only one dose at a time is mixed with about twenty drops of water and this sprayed, preferably into the unaffected side, if a unilateral case. Orthoform, about 20 gr. (grammes 1·3) insufflated (Fig. 3) into the affected side, is an anodyne of some

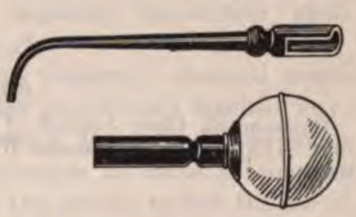
FIG. 3.—Insufflator for the application of powders to the nose and throat.

service, and ¼ gr. (gramme ·016) of morphine sulphate may be added. The general headache when due to pressure is relievable only by morphine. If used intranasally much less will suffice. Dyspnœa and dysphagia, when due to the protrusion of the mass into the pharynx and not to involvement of the lower pharyngeal walls, may be relieved by snaring off, or removing with the forceps, sufficient of the protruding mass to give relief. As suggested by Lambert Lack, this may be done by the finger in very soft growths. The ligation and excision of both external carotid arteries and all of their branches, as suggested by Dawbarn for retarding the growth of inoperable malignancy, located in the area supplied by this vessel, has in my experience been very effective in retarding growth and relieving pain in many cases of nasal and antral malignancy. It has seemed to fail in all growths located high up, probably for the reason that these get a collateral supply from intracranial sources.

CHEVALIER JACKSON.

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NEW GROWTHS OF THE NASO-PHARYNX.

Growths of the Naso-pharynx include those which, while not having their point of origin in this region, nevertheless, by reason of their occupancy of the naso-pharyngeal space by their bulk, require special methods of treatment. Aside from fibromata, benign growths springing from the naso-pharyngeal walls are exceedingly rare. They may be removed with adenoid forceps guided by the finger. Most frequently met with are the fibromata springing from the nasal cavities or from the vault of the naso-pharynx. These growths are exceedingly dense and hard. They grow downward, invading the pharynx, impeding deglutition until serious inanition supervenes, and impeding respiration until asphyxia is threatened, especially at night.

Surgical removal is the only curative measure. General anæsthesia is necessary, and this necessitates preliminary tracheotomy, for if attempted without a tracheal opening the bulk of the endo-pharyngeal mass will cause the respiration to cease as soon as anæsthesia is sufficiently advanced for the patient to lose the aid of the voluntary accessory muscles of respiration. Unconsciousness is synchronous with respiratory arrest. Tracheotomy also permits of tamponnade of the pharynx to prevent aspiration or swallowing of blood. In the writer's opinion it is a wise precaution to ligate the external carotid artery, also as a preliminary, on one side if the origin is unilateral, on both sides if the attachment is median. This forestalls hæmorrhage and shock. Some cases bleed very little, others very profusely. Two of my colleagues have each lost a case upon the table from hæmorrhage. Three of my own cases would have bled seriously had I not ligated the external carotid artery as a preliminary. This ligation is simple and easy for the surgeon and does not add to, but lessens the total operative risk. Having done the tracheotomy and the external carotid ligation, the growth may be rapidly severed at its base by a very heavy snare, armed with heavy piano wire, and introduced through the nose or mouth. Operators who do not favour preliminary arterial ligation advise slow snaring. Some operators prefer special forceps for removal. Post-operative tamponnade of the pharynx is advisable. The operative risk is very slight if hæmorrhage is forestalled by ligation and respiratory arrest and aspiratory pneumonia by tracheotomy.

Statistics of mortality are misleading as, until recently, a formidable preliminary operation upon the bones of the face, to gain access to the growth, was deemed necessary. The rhinologist has devised ways by which trained fingers can remove a post-nasal fibroma of any size through the natural passages. Recurrence may require re-operation, but an ultimate cure is almost certain in pure fibroma.

Malignant Disease of the Naso-pharynx.—Fibro-sarcoma is of more grave prognosis, yet cures have been obtained by Tilley and others. Sarcoma, carcinoma and endothelioma are so certain to repullulate because of the necessarily inadequate removal that no operation upon them is advisable. The same palliative measures advised for nasal malignancy are applicable to naso-pharyngeal malignancy.

New Growths of the Oropharynx (*see* p. 784).

New Growths of the Laryngopharynx (*see* p. 786).

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ACUTE RHINITIS.

Acute rhinitis or acute inflammation of the nasal passages may be best considered under the following headings:

(1) Simple acute rhinitis; (2) purulent rhinitis; (3) fibrinous rhinitis; (4) vaso-motor rhinitis; (5) traumatic rhinitis.

SIMPLE ACUTE RHINITIS.

Acute nasal catarrh (coryza, the ordinary cold in the head) is usually a minor ailment, and probably the majority of sufferers prefer entirely to neglect its treatment. A cold may, however, be a more serious affair in the young, in the old, and in those who suffer from very severe attacks or are liable to complications. People who suffer from catarrhal affections of the middle ear, or who have a tendency to bronchitis or pulmonary troubles, should never neglect a cold. Singers and professional voice-users must also take full precautions.

In the earliest stages a cold may sometimes be arrested. If possible, the patient should go straight to bed, or at least be confined to one room in a warm, even temperature. Free perspiration should be induced by a hot bath, followed by plenty of hot drinks, such as hot whisky and water, or lemon and water or gruel. The most useful drug at this time is opium. It may be given in the form of a full dose of Dover's powder at bed-time, or in 5 minim [U.S.P., 3 minim] doses of the tincture every three or four hours. The following mixture can be recommended: Liq. morphinæ hydrochlor., ♏5; liq. ammon. acetat., ʒij; aquam, ad ℥j. [U.S.P., morphinæ hydrochlor., gr. $\frac{1}{22}$; liq. ammon. acetat., ʒij; aquam, ad ℥j]. To be taken every three hours until sleep or profuse perspiration is induced. In some cases a cold may be warded off by a single large dose (5 to 8 gr.) of quinine, or by spirits of camphor in 10-minim, or by carbolic acid in 1-gr., doses, repeated every three hours. As local remedies Ferrier's snuff has been recommended, and the popular catarrh remedies, which usually consist of strong inhalations of ammonia and carbolic acid, are sometimes effectual. Some people find the application of menthol ointment soothing, or menthol inhalations may be tried. Applications of cocaine or of supra-renal extract in any form are dangerous and should be avoided.

At the **commencement of a cold** relief may be given by a hot steam inhalation containing the compound tincture of benzoin or menthol. A teaspoonful of the tincture of benzoin, or twenty drops of a 10 per cent. alcoholic solution of menthol, should be added to 1 pint of water at a temperature of about 140° F. Each inhalation should last three to four minutes, and may be repeated every four or five hours. The smarting in the nose may sometimes be relieved by the application of very weak boracic or menthol ointment or plain lanolin. The general treatment as above described should be continued, and a brisk purge may be administered.

During the **second stage** of the cold, when the nasal secretion is profuse and watery, little besides this general treatment can be carried out. The patient should take a sufficiency of warm fluids, avoid exposure to draughts and chill, and take plenty of warm nourishing food. He should stay in bed one or two days, and if the weather is cold or treacherous or the patient delicate, he must stay in the house two or three days longer.

As the discharge lessens and becomes more sticky and muco-purulent, much relief will be obtained by the use of a simple alkaline nasal wash. One of the simplest and best lotions is a solution of bicarbonate of soda and ordinary salt, a teaspoonful of each to 1 pint of warm water. About 3 oz. of this may be sniffed up the nose two or three times a day, and continued until all discharge has ceased. If the nostrils are red and excoriated, simple lanolin or vaseline or weak boracic ointment should be frequently applied. If the cold shows any tendency to persist, a change of air especially to the seaside, combined with a suitable tonic, such as iron and strychnine, will probably complete the cure. If in spite of this nasal discharge continues, the nose should be carefully examined for any signs of infection of the accessory sinuses.

Prophylaxis.—If a patient is particularly liable to colds, the nose should be carefully examined for any chronic nasal trouble. In children adenoids should be sought for, and in adults any cause of nasal obstruction, such as hypertrophy of the inferior turbinates or polypus. If the nasal obstruction is remedied, the liability to colds frequently disappears. Ill-nourished children should be ordered a suitable diet, and the regular administration of cod-liver oil during the winter is often of great value. General precautions should also be taken, clothing should be warm and light, ill-ventilated, stuffy rooms should be avoided, and, when possible, the patient should be recommended to sleep with the windows open all the year round (*see* also Vaccine Therapy, p. 262).

PURULENT RHINITIS.

Purulent rhinitis is usually met with in children, and follows a neglected cold or one of the severer infections, such as influenza, scarlet fever, or other exanthem. If neglected, it may set up serious changes in the mucous membrane, and end in atrophic rhinitis or ozæna. The purulent rhinitis of childhood is entirely distinct from the suppuration in the nasal accessory sinuses which occurs in adults.

The treatment is important in view of the degenerative changes which may rapidly occur in the mucous membrane. The nose should be frequently syringed with weak antiseptic lotions, such as a weak solution of boric acid or of bicarbonate of soda and salt. Dilute nitrate of mercury ointment is a valuable remedy. It may be made soft with vaseline, and a piece about the size of a pea inserted into each nostril two or three times a day after syringing; or it may be mixed with oil and applied with a brush, as in the following formula: ℞ Ung. Hydrarg. Nitrat., ʒj; Paroleine, ℥ss; Ol. Amygd., ℥ss.

Cod-liver oil or other tonics should be prescribed, with a generous diet, and after a time a change of air. The treatment must be persistently carried out until all discharge has ceased. If the disease occurs in young infants, the nasal obstruction may produce great difficulty in sleeping and suckling. Syringing may clear the nose, and should be carried out two or three times a day. Food must be administered with a spoon.

FIBRINOUS RHINITIS.

Fibrinous rhinitis is an acute inflammation of the nose, associated with a purulent or profuse watery discharge and a fibrinous exudation on the nasal mucous membrane. The fibrinous deposit may come away in shreds or in large pieces, forming almost complete casts of the nose. The discharge is sometimes scanty, is often fœtid and blood-stained. The disease is due to the Klebs-Löffler bacillus. It runs a somewhat chronic course, lasting three to six weeks, produces little or no constitutional disturbance, and is never followed by paralysis or other symptoms characteristic of diphtheria.

When fibrinous rhinitis is suspected, the patient should be at once isolated and the nasal discharge examined either by immediate staining of film preparations or by culture for the Klebs-Löffler bacillus. The treatment must be carried out exactly on the same lines as for purulent rhinitis. The child must be kept quiet, given plenty of food, and if necessary a tonic, but he is rarely sufficiently ill to require confinement to bed. As a rule complete recovery ensues. The administration of diphtheria anti-toxin is apparently useless. The child should not be allowed to associate with others until all bacilli have disappeared from the nasal secretion.

VASO-MOTOR RHINITIS.

For the treatment of this affection, *see* Paroxysmal Rhinorrhœa, Hay Fever, Nasal Neuroses.

TRAUMATIC RHINITIS.

Traumatic or "trade" rhinitis results from the inhalation of irritating particles, and occurs in two distinct forms. The more severe form is due to the inhalation of chemical irritants, and occurs amongst workers in bichromate of potash, arsenic, mercury and similar metals. The simpler form is met with amongst workers in dusty occupations, such as millers, brush makers, librarians and various metal workers. In the latter cases the dust acts simply as a mechanical irritant, and produces an affection practically identical with rhinitis sicca, under which heading the treatment is fully discussed (p. 711).

The treatment of the more severe form consists in its prompt recognition and in the immediate removal of the patient from the noxious surroundings. The inflammation in these cases may be very acute, and result in ulceration, sloughing, and destruction of the septum and adjacent parts. The nose should be frequently irrigated with mild antiseptic lotions, such as boric-acid solution, and an ointment, such as plain vaseline or weak boric-acid ointment, should be applied frequently to the nose.

H. LAMBERT LACK.

CHRONIC RHINITIS.

SIMPLE CHRONIC RHINITIS.

\ SIMPLE chronic rhinitis is usually the result of severe or eated attacks of acute nasal catarrh, especially if neglected, and nost common in those who suffer from narrowness of the nasal sages or from nasal obstruction from any other cause. The lling of the turbinates may be due to simple œdema and vascular gorgement, but sooner or later this produces and becomes ociated with more or less permanent thickening of the nasal cous membrane. The mucous membrane of the whole inferior atus, but more particularly the inferior turbinate, is affected. e nasal secretion is usually excessive and muco-purulent in racter.

'he treatment must be general and local; the latter is the most portant. In the first place the nose should be carefully examined, l any definite cause of nasal obstruction should be remedied. noids, hypertrophy of the inferior turbinates, deflection or kening of the nasal septum, if causing obstruction to free athing, must be removed. If the nasal passages are fairly wide the obstruction is due to simple swelling of the mucous memne, simple alkaline lotions should be prescribed. One of the st generally useful is a solution of equal parts of bicarbonate of a and chloride of soda (3 gr. of each to 1 oz. of water). This y be varied by adding carbolic acid (1 gr. to 1 oz.), chloride of nonia (3 gr. to 1 oz.), or when the secretion is profuse, a weak ingent may be added such as hazeline (20 minims to 1 oz.). other useful astringent lotion is equal parts of rectified spirit glycerine of borax (1 teaspoonful of the mixture to be added oz. of warm water). These lotions may be conveniently used ' sniffing" them up the nose from a glass or from the palm of hand, and about 2 oz. is sufficient for each time; or one of the ious nasal cups or irrigators may be tried. When there is much ky muco-purulent secretion, a large nasal irrigator, holding rly ½ pint, may be conveniently used, or the nose may be nged. A large glass syringe with a small piece of rubber ing attached to the nozzle, or an ordinary " Higginson " syringe, be found most convenient.

he general treatment consists in maintaining the patient's health by the administration of plenty of good food, fresh air and the correction of any digestive or other trouble. Change of air to the seaside or to a warm, dry climate may be strongly recommended, and tonics, such as cod-liver oil or iron and strychnine, should be prescribed.

If in spite of these measures the nasal obstruction and swelling of the mucous membrane continue, more active treatment must be adopted. The best method is probably the application of the galvano-cautery to the inferior turbinates. The part to be cauterised is first thoroughly anæsthetised with cocaine. It is best to use a solution of cocaine with supra-renal extract. Pledgets of wool soaked in this solution and lightly squeezed may be placed in contact with the mucous membrane and left in position for about half an hour, by which time the parts will be thoroughly anæsthetised. If preferred, the cocaine may be applied by gently and repeatedly brushing it over the parts, using a small mop of wool on a probe; but a spray is dangerous, and should never be allowed. The reduction of the swelling by the astringent action of the supra-renal extract enables the nose to be more easily inspected, and allows the cautery to be more accurately applied. It greatly diminishes the risk of injury to the mucous membrane of the septum, an accident to be carefully avoided for fear of subsequent adhesions. Two or three superficial linear cauterisations should be made along each inferior turbinate. For the first few days after the application of the cautery there may be pain and increased obstruction; but soon the swelling subsides, and the ultimate shrinking from even a single application of the cautery may be considerable. Chemical caustics, such as nitrate of silver, tri-chloracetic acid or nitric acid, may be used instead, but are not so convenient. After using the cautery weak boric acid or some similar ointment should be applied to the nose two or three times a day, a piece about the size of a bean being inserted into each nostril and sniffed up. After a day or two the nasal lotions should also be continued. Two or three applications of the cautery to each inferior turbinate may be required, and in simple cases this is usually quite successful. If it is not sufficient to provide a free nasal passage, portions of the inferior turbinates should be removed although they are not hypertrophied. The operation will be described under Hypertrophic Rhinitis.

ATROPHIC RHINITIS.

Atrophic rhinitis is usually the result of purulent rhinitis, and commences in childhood. A purulent rhinitis may follow scarlet fever, measles, or other exanthem, or a neglected cold, and if allowed to become chronic may produce marked changes in the nasal mucous membrane. The ciliated columnar epithelium degenerates and ultimately becomes replaced by squamous non-ciliated cells, the glands atrophy, the blood-vessels are obliterated, and the mucous membrane becomes much thinner and more fibrous than normal. The sclerosed condition of the mucous membrane inhibits the further growth of the turbinate bones. The affection is usually limited to the structures forming the inferior meatus of the nose, but the middle meatus may be involved in severe cases. As a result of these changes the nasal fossæ are unduly wide, and the nasal secretion is deficient in water and more tenacious than normal. Partly from these causes and partly from the absence of ciliary movements, the discharge tends to collect in the nose, where it is exposed to evaporation in the respiratory air-current and dries into crusts, which provide a nidus for the growth of various bacteria. Decomposition follows, imparting intense fœtor to the breath, and exciting by its irritating products further secretion.

Among the more frequent complications of atrophic rhinitis may be mentioned suppuration in the accessory sinuses, and especially in the antrum and sphenoidal sinus, dry post-nasal and pharyngeal catarrh, chronic laryngitis and a tendency to pulmonary affections. General ill-health, anæmia, dyspepsia, and deafness from Eustachian catarrh may also occur.

Local Treatment.—Although from the nature of the pathological changes which have taken place in the nasal mucous membrane it is obvious that atrophic rhinitis is essentially incurable, much may be done for the relief of the worst symptoms. The first essential is to cleanse the nose, and this is best carried out by syringing. A Higginson's syringe will be found most convenient, as it is necessary to inject a large quantity of fluid (1 to 2 pints) at each sitting. It matters little what is used: weak boric acid lotion, made by dissolving two teaspoonfuls of boric-acid crystals in 1 pint of boiling water, or a solution of ordinary salt and bicarbonate of soda (1 drachm of each to 1 pint of water) are as good as anything. If much fœtor is present, sanitas, permanganate of potash, or listerine may be added to the salt solution. The syringing should be carried out night and morning until the nose is quite clean, then once a day will usually suffice. If the patient has much trouble in getting the nose clean, the surgeon should superintend the syringing for a few days, and should detach any particularly adherent crusts by lightly rubbing the mucous membrane with a mop of wool on a probe. This mop may be dipped in peroxide of hydrogen. It will be necessary for the patient to continue the syringing at least once a day for the rest of his life, but if he does this he will probably keep entirely free from the most unpleasant symptoms associated with his condition.

Local Complications.—When the patient comes under treatment, and also later from time to time, the nose should be carefully examined for any sign of sinus suppuration. The antrum and sphenoidal sinus should be carefully examined on repeated occasions, and if there is any doubt as to the condition of either sinus, it should be punctured or its condition definitely ascertained in some other way (*see* articles Antrum Suppuration, Sphenoidal Sinus Suppuration). The existence of these complications adds greatly to the nasal trouble. Their treatment will be found discussed under a proper heading; but this much may be said here, that if antrum suppuration is present it is necessary to do a radical operation, preferably an operation conducted entirely through the nose, and that such methods as alveolar puncture are useless. The treatment of other complications of atrophic rhinitis, such as pharyngitis, laryngitis and ear troubles, should also be sought for under appropriate headings.

General Treatment.—The patient's general health must be attended to. In the earlier stages the child should be placed under the best possible hygienic conditions, and a change to the seaside of some months' duration may be most beneficial. It is in the early, purulent stages that the best chance exists of arresting the affection. General tonic measures may be adopted as necessary.

Other forms of treatment may briefly be alluded to. Numerous methods have been recommended from time to time, have had their vogue and disappeared, but some are useful as adjuncts.

Packing the Nose is a very useful aid to cleansing. By excluding the passage of the respiratory air, evaporation is prevented, and the nasal secretion remaining fluid, as when first secreted, runs or is easily washed away. The packing may be carried out with strips of cyanide or sterilised gauze. A strip about 9 to 12 inches long and 1 inch broad can usually be inserted into the inferior meatus on each side. It causes considerable discomfort at first, but the patient soon learns to tolerate it and then to like it, because it relieves the symptoms. The strip of gauze must be changed twice daily when the nose is syringed, but at first, owing to the large amount of secretion, it may be necessary to change it more often. The patient can sometimes push the strip into the inferior meatus and leave the middle meatus clear for breathing, and thus at the same time that the nose is packed enjoy the advantage of nasal respiration. The packing may be continued indefinitely. As a rule it produces no irritation and is easily inserted and removed; but if it becomes adherent or produces bleeding it is best to dip it in oil or ointment. Some patients prefer to wear the packing at night and to leave it out during the day.

Friction or Vibratory Massage to the turbinates has been specially recommended to improve the nutrition of the mucous membrane. It consists essentially in rubbing the mucous membrane with little mops of wool on a probe. As an aid to cleansing the nose it is certainly useful, as a method of restoring or increasing the nutrition of the nasal mucous membrane it is probably useless. Special instruments have been invented for producing rapid vibration: these are useless.

Paraffin Injections.—Attempts have been made to diminish the width of the nasal fossæ, and so to increase the expulsive power of the expiratory blast, by filling out the shrunken turbinates with injections of melted paraffin. The technique of this operation is the same as for the injection of paraffin for deformities (*q.v.*). The paraffin is injected into the inferior turbinates and also into the mucous membrane of the septum. It is not difficult to do it when the mucous membrane is fairly loose, but in the worst cases, when the inferior turbinate is represented by a mere ridge of bone covered by a thin, closely-adherent membrane, it is impossible to plump this ridge out to anything like the size of a normal turbinate. A few patients are improved by the treatment; but, as a rule, the results are disappointing. Even if the turbinate is restored to its normal size, its essential structures, the ciliated epithelium and the glandular secreting tissues, are not replaced.

Partial Blocking of Anterior Nares.—Another method designed to increase the nutrition of the mucous membrane offers a better chance of success. The anterior nares are partially blocked by introducing a small piece of rubber tubing, or by some similar method which is not enough to prevent nasal breathing but sufficient to make it difficult. If now the patient attempts to breathe through the nose perseveringly, a negative pressure is produced, and the nasal mucous membranes are flushed with blood. This method might be a success, especially in children with slight disease, but requires considerable perseverance on the part of the patient. Perhaps the same object might be accomplished by a suitable modification of Bier's passive congestion instruments.

Anti-toxins and Vaccine Treatment.—Owing to the fact that the Klebs-Löffler bacilli, or organisms closely resembling these, have often been found in the secretion of atrophic rhinitis, diphtheria anti-toxin has been used in the treatment of the disease. It is hard to see how it could possibly do any good even if the original trouble were due to diphtheria. Various vaccines also have been prepared from some of the organisms found in the crusts, but their use has not been followed by any definite success.

HYPERTROPHIC RHINITIS.

Hypertrophic rhinitis is the sequel and result of chronic rhinitis. Long-continued congestion of the mucous membrane leads to increase of the connective tissues, a true hyperplasia of the inferior turbinate. The irregular deposit of fibrous tissue gives rise to a papillated, mulberry-like appearance of the inferior turbinate, usually most marked on its posterior ends. This condition gives rise to nasal obstruction, especially marked on expiration, and the nasal secretion is usually increased. Muco-pus may often be seen on the floor of the nose entangled in the papillomatous hypertrophies.

In the milder cases with much swelling and little true hyperplasia, treatment may be adopted as for simple chronic rhinitis (*see* above). Alkaline lotions may be ordered, and the electric cautery or chemical caustics applied to the hypertrophied mucous membrane. When the hypertrophy is considerable or the nasal passages are excessively narrow, operative treatment will be necessary. Pedunculated or papillomatous masses may be removed with the cold wire snare under local anæsthesia. The affected part should be well anæsthetised by packing it all round with pledgets of wool wrung out of a solution of cocaine and supra-renal extract. The anterior ends of the turbinates, if involved, are first attacked, and then subsequently pieces removed until the posterior ends come into view. These also may be removed through the anterior nares. With good illumination a view can easily be obtained of the part. If this is impossible, the wire loop may be guided over the posterior end of the turbinate by means of the left index finger passed up into the post-nasal space. This manœuvre causes the patient a good deal of pain and discomfort, and when it is necessary it is generally better to give a general anæsthetic.

In all severe cases, especially in nervous patients, it is better to operate under general anæsthesia. The anæsthetic should be light, so that the cough and swallowing reflexes are not abolished, and the nose should be packed, for half an hour or more before the operation is commenced, with a solution of cocaine and supra-renal extract. As much of the inferior turbinate as necessary may then be cut away with nasal scissors or shears, or with Mahu's or

Grünwald's punch forceps. The application of supra-renal extract permits this to be done almost without hæmorrhage, and thus promotes accuracy. The amount to be removed depends upon the width of the nose. A strip should be taken off each inferior turbinate, just sufficient to allow free nasal respiration. On examining the nose it should be possible to see at least half-way down the inferior meatus, but it should not be possible to see into the post-nasal space. It is always better to deal with the inferior turbinate in this way. The spoke-shave should never be used, for fear of taking away too much. It must be remembered that after using supra-renal extract there is some danger of reactionary hæmorrhage, and means should be at hand for packing the nose, but it is not advisable to pack the nose as a routine measure. For the same reason no hot food should be allowed in the first forty-eight hours, and the patient should keep as quiet as possible and take food and drinks cold. He should avoid exertion and vigorous attempts at blowing the nose.

RHINITIS SICCA.

Rhinitis sicca is characterised by abnormal dryness of the nasal mucous membrane. On inspection the mucous membrane in the path of the air-stream will be found covered with dry mucous crusts, which in towns are usually black. These crusts collect especially on the anterior part of the septum and on the anterior ends of the middle turbinate. Rhinitis sicca occurs in three distinct conditions. It is common in anæmic, dyspeptic, constipated women, where the nasal fossæ are usually wide and the mucous membrane pale and dry. It is also frequent in middle-aged, gouty, alcoholic men. In these patients the mucous membrane is congested, often dark red, dry and glazed. The throat also appears congested, dry and irritable, the tongue is furred, and the breath smells of alcohol. In both classes of case the condition may be aggravated by exposure to dust. Certain occupations may be alone sufficient to produce the disease. Thus it is common in librarians, brush makers, and people following similar occupations in which much fine dust is inhaled.

Both general and local treatment are essential. Alcoholic patients must be carefully dieted, the alcohol restricted, and the gastric disturbances rectified. Anæmic patients must be appropriately treated with tonics after any digestive or other disturbance has been remedied.

Local treatment is important. The nose should be washed out with a weak alkaline lotion once or twice a day. A solution of bicarbonate of soda and salt (3 gr. of each to 1 oz.) may be strongly recommended. Chloride of ammonium (3 gr. to 1 oz.) may be added to this as a change. For the various methods of using these lotions *see* Chronic Rhinitis. Hot steam inhalations containing creosote or menthol are often useful, especially for the accompanying pharyngeal and laryngeal catarrh. After cleansing the nose, in the more severe cases, oily applications should be made. When the anterior part of the septum is excoriated by the frequent detachment of the crusts, the oil should be applied to the affected part with a small camel's-hair brush, or, better still, the part should be smeared with ointment. In other cases a coarse nebuliser or atomiser may be used to spray the oil into the nose. As an oily spray menthol (5 gr.) with eucalyptus oil (20 minims) may be added to 1 oz. of paroleine or fluid vaseline. Any weak ointment, such as dilute boric acid or dilute nitrate of mercury ointment, preferably prepared with soft vaseline, may be ordered. This treatment must be continued for months; in the more severe and chronic cases it may always be necessary for the patient to syringe the nose at least once daily. When the septum is affected the application of oil or ointment to the excoriated area should be carefully and regularly carried out. Not only will this prevent the attacks of epistaxis which are liable to occur (*vide* article Epistaxis), but it will also tend to prevent the atrophic ulcer and ultimate perforation of the septum. Cases are occasionally seen in which one nostril is wide and dry whilst the other is narrow and moist. Here it may be advisable to perform a sub-mucous resection of the septum, so as to give both nostrils equal work. Great care is necessary to avoid a perforation, as the mucous membrane on one side of the septum is often thin.

H. LAMBERT LACK.

RHINOSCLEROMA.

This disease is largely confined to eastern and south-eastern Europe and is rarely met with in this country. It begins as an infiltration of small cells which, becoming spindle-shaped and forming connective tissue, gives to the tissues a peculiar cartilage-like hardness. It may occur primarily in the naso-pharynx, though it generally starts in the nose with discharge and with neoplasms which are at first soft and afterwards become very hard. A diffuse infiltration of the mucous membrane produces firm cicatrices which lead to contraction and stenosis. From the nose it extends to the upper lip and deeper parts, to the mouth and cheek, into the naso-pharynx, soft palate, faucial pillars and larynx. It is exceedingly hard to the feel. Treatment is practically without result. Local cleansing with antiseptics has been tried. Careful extirpation of all diseased parts by knife or sharp spoon has been carried out, sometimes with a measure of relief. Contraction and stenosis may be remedied by scraping the nodules and passing bougies and laminaria tents. The disease makes slow progress and the patient may be kept alive for years. Medicinally solutions of arsenic in the strength of 1 per cent. to 12 per cent. injected into the parts have been found useful and more recently atoxyl has been recommended. The infiltration on the outer part of the nose has been improved by exposure to X-rays, soft tubes being used and the remainder of the face protected. Sometimes an attack of erysipelas produces temporary improvement.

D. R. PATERSON.

SYPHILIS OF THE NOSE.

The general treatment of cases presenting nasal lesions differs in no way from that of syphilis of other parts, excepting that it should in the tertiary stage be especially energetic, in view of the considerable advance which the disease has usually made before the patient comes for treatment, and of the rapidity with which destruction of portions of the nasal skeleton may take place. Iodide of potassium in full doses should be given in a mixture combined with an alkali, and continued for at least four weeks after healing is complete. The patient should then undergo a regular course of mercurial treatment, preferably by inunction or subcutaneous injection.

Local treatment in those rare cases in which the primary lesion is situated within the nose consists in cleansing the surface of the sore and dusting it with iodoform, calomel or dermatol powder. For a sore on the outer surface of the nose the emplastrum hydrargyri is a good application.

During the secondary stage the "coryza syphilitica" rarely requires treatment, but if there is much discharge an alkaline nose wash should be used, the fluid being either sniffed up the nose from the hand or a tumbler, or introduced with a nasal irrigator. Mucous patches about the nasal vestibule should be covered with white precipitate ointment.

In the tertiary stage when, as is usually the case, deep ulceration is present, together with necrosis of bone or cartilage, it is extremely important that the nose should be kept free from the very offensive pus and crusts which tend constantly to accumulate. For this purpose a simple alkaline nose wash may be used or a weak antiseptic solution, such as Sanitas, 30 min., or potassium permanganate gr. $\frac{1}{8}$ to 1 oz. of water. In such cases the nasal cavities are often wide owing to previous destruction or to the atrophy which is so marked a feature of the later stages of the disease, and then some form of syringe is essential for efficient cleansing. The best instrument is a simple 3 oz. nasal ball syringe, the fluid being injected *gently* through the narrower nasal cavity while the patient breathes deeply through the mouth. Following the wash, and in order to prevent the re-accumulation of crusts, a spray such as the following should be used in an atomiser:

℞. Ol. Eucalypti, ♏ 10; Ol. Pini Sylvestris, ♏ 5; Menthol, gr. 5; Paraff. Liquid., to ℥j. If the crusts cannot be removed by syringing alone they may be first loosened by allowing a strip of 1-inch ribbon gauze to lie in the nose for from half an hour to an hour, after which syringing will as a rule be effectual.

Ulcers should be powdered with iodoform, iodol, or aristol, or vaporised calomel may be blown on to their surface from a special porcelain insufflator provided with a spirit lamp. Granulations, if large, should be destroyed by applications of solid silver nitrate or chromic acid fused to a probe, the surface being afterwards covered with powder. Sequestra should not be removed until they have become quite loose. When, however, this is the case, nothing is gained by waiting, and it must be remembered that they may if left alone fall backwards into the throat and become impacted in the larynx. If of moderate size, they should be removed with polypus forceps under local or general anæsthesia; if too large to pass through the nostril, they should be previously cut up or crushed with strong forceps and removed piecemeal. Very rarely when the sequestrum is of great size an operation such as that of Rouge may be required.

In the late stages large fibrous granulomata, sessile or pedunculated, are sometimes found and require removal with snare or cutting forceps. Adhesions between the septum and turbinals must be divided and the opposing raw surfaces kept apart by means of gauze packing until healing is complete.

THOMAS GUTHRIE.

DISEASES AND AFFECTIONS OF THE ACCESSORY SINUSES OF THE NOSE.

The treatment of the diseases of the accessory sinuses of the nose entails an accurate knowledge of the anatomy of the nasal cavities and a familiarity with the method of their examination by means of reflected light. The anatomical variations of the nasal fossa and adnexa are so numerous, that it is often difficult to tell whether the object seen is normal or pathological. In the scope of this work there is no place for a detailed account of these anatomical abnormalities, but it is necessary to remind the physician of the main sub-divisions of the accessory sinuses, in order to appreciate at once the course of disease and the methodical undertaking of its treatment.

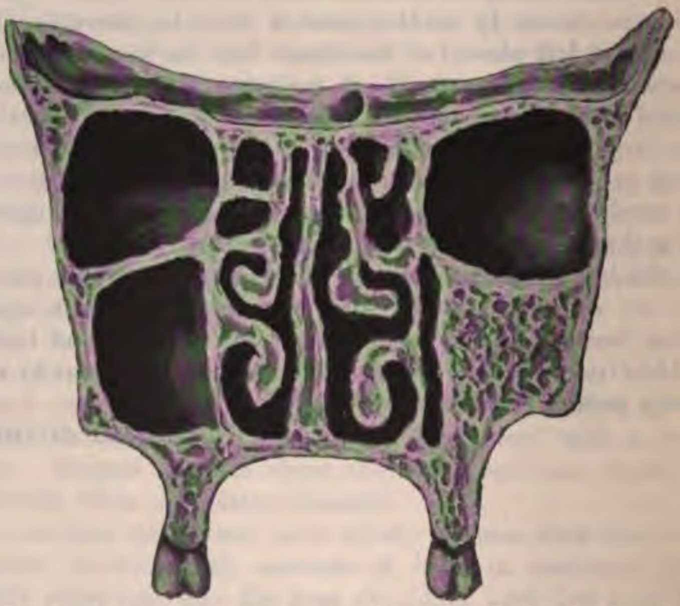

FIG. 1.—A transverse vertical section through the skull at the situation of the sixth year molar tooth. There is a unilateral circumscribed Antrum of Highmore on the left side.

The accessory sinuses of the nose consist of the maxillary, ethmoidal, frontal and sphenoidal cavities, and are formed by an invasion of the nasal mucous membrane into spaces formed in the bones of the face and skull at various periods. The maxillary sinus begins to be formed about the fourth month of fœtal life, but at birth this is the only accessory cavity present. During dentition the maxillary space is occupied by the non-erupted teeth. The other sinuses first excavate the bone during childhood, and are small until puberty, but after that time they enlarge considerably, even up to a late period in life, by absorption of the cancellous bone in the neighbourhood.

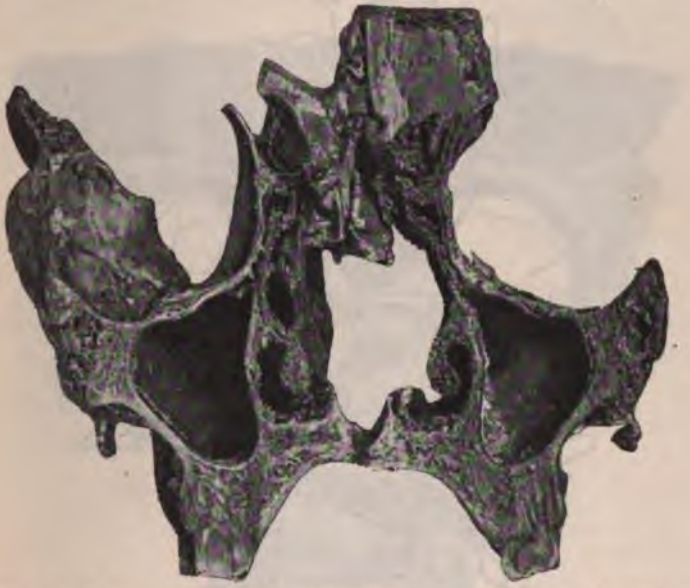

FIG. 2.—A transverse vertical section through the skull at the site of the second molar tooth, showing the relative positions of the floor of the sinus and the nasal floor. The natural opening is seen higher up.

The following instruments are required: A forehead laryngoscopic mirror, or a "photophore," fitted with an electric lamp of about 8 to 10 volts, a nasal speculum, preferably Chiari's or Hartmann's pattern, which can be held comfortably in the left hand while examining or operating, and with which the degree of dilatation of the nostril can be modified with ease; one or two probes of plated copper or German silver, so that they can be bent at different angles; nasal forceps with narrow blades, grooved or serrated, to hold wool or to remove packing, and a set of aluminium wool carriers with handles. Two or three cannulæ are requisite also for washing out the sinuses.

The nasal cavity is first examined by anterior rhinoscopy, the inferior and middle meatuses are searched for discharge. The next step is to apply a 5 per cent. solution of cocaine, with a small quantity of adrenalin solution, to the whole nasal fossa.

For all operative procedures in the nose a 20 per cent. solution of cocaine should be used. This should be applied by means of wool wound on the end of a carrier, and the tampon rubbed over the mucous membrane; the use of a spray should be avoided as it readily induces cocaine toxæmia. After the lapse of a few minutes the nasal cavity will be widely opened, and the source of the discharge can probably be seen and followed with a probe. The nasal fossæ should next be examined by posterior rhinoscopy.

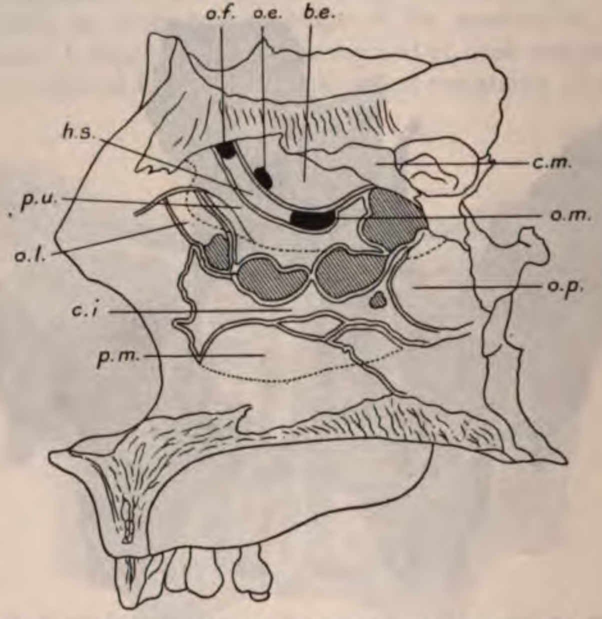

FIG. 3.—Inner wall of Antrum of Highmore showing bony and membranous parts—bones shown in double outline, membranous parts shaded. (F. H. W.)

h.s., hiatus semilunaris; *o.e.*, ostium ethmoidale; *o.p.*, os palatinum; *o.f.*, ostium frontale; *o.m.*, ostium maxillare; *o.l.*, os lachrimale; *c.m.*, concha media; *c.i.*, concha inferior; *b.e.*, bulla ethmoidale; *p.m.*, processus maxillaris; *p.u.*, processus uncinatus.

Suppuration in the accessory sinuses accounts for the majority of cases of disease, but they may be the seat of neoplasms, foreign bodies or injury.

When a discharge of a light yellow colour is seen issuing from the middle meatus it should be wiped away and the patient left for a few moments. On again looking into the nostril, if pus is seen in the same situation, it must come from the maxillary sinus, the frontal sinus, or the anterior ethmoidal labyrinth. If the pus is seen between the middle turbinal body and the nasal septum it proceeds from the posterior ethmoidal labyrinth which opens into the superior meatus. In this case, also, it will be seen by posterior rhinoscopy trickling over the posterior end of the middle turbinal body.

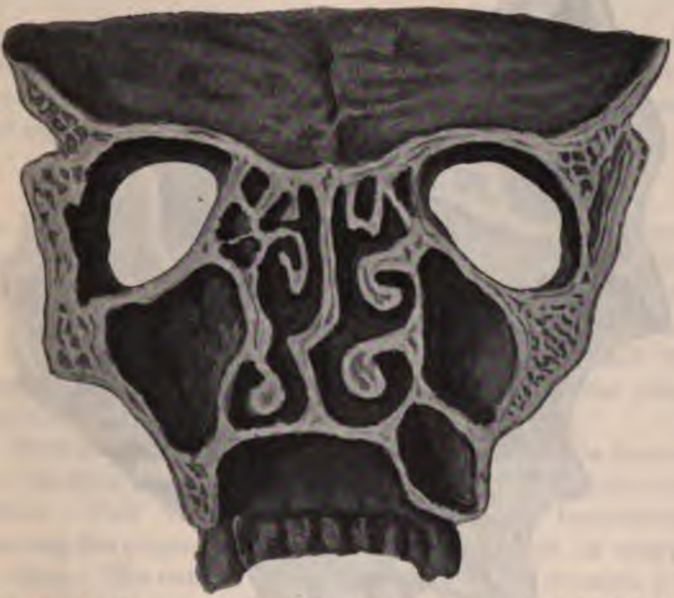

FIG. 4.—Dentigerous cyst of maxillary alveolus, causing high level floor of maxillary sinus.

Pus coming from the sphenoidal cavity will be found tracking down the posterior wall of the naso-pharynx on the diseased side.

If no discharge is seen, there may still be an empyema of a sinus which is known as a "closed" empyema, that is, where the natural opening of the sinus is blocked by polypi, granulations, new growths or a foreign body. The distension of the walls of the sinus and the pain will assist in the correct diagnosis. The principles of treatment consist in a free drainage of the sinus in the most favourable position.

In all suspected cases the maxillary and frontal sinuses should be examined by trans-illumination. A small electric lamp on a vulcanite spatula, or a Vohsen's lamp, which can be used for the maxillary or frontal sinuses, should be employed. The room having been made absolutely dark, the lamp is placed in the mouth to examine the maxillary sinus, the lips are closed over the lamp, and the circuit of current completed. Where there is a collection of pus, polypi or granulations in the cavity, the light passing through the maxilla will not be seen so brightly over the cheek as on the other side of the face. This shadow is more distinctly marked below the orbit and towards the malar bone. The patient should be directed to look up, and notice if he can detect the light in the eye on both sides. This method of examination is not always satisfactory owing to the thickness of the walls of the maxilla, more particularly the palatal process, or a deep alveolus with a large number of teeth remaining in the jaw. By means of trans-illumination, it is possible in some cases to diagnose dead

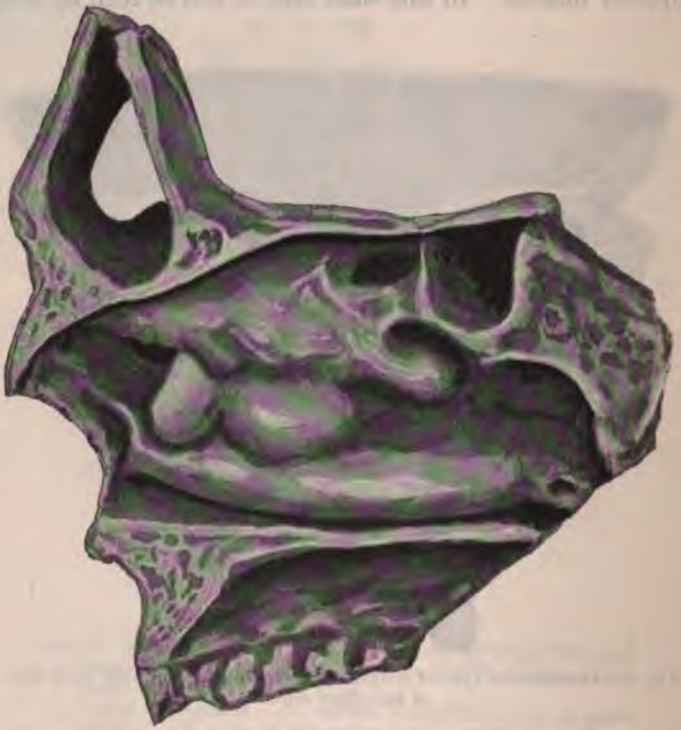

FIG. 5.—Sagittal section through the right nasal fossa, showing polypi springing from the middle turbinal. The frontal cavity is very large.

teeth. By passing the lamp along the alveolus and pressing the cheek against the teeth, a shadow will be thrown by a dead tooth, whereas the sound teeth are transparent. Trans-illumination may deceive us when a circumscribed antrum is present, as in Fig. 1. For the examination of the frontal sinus, a rubber cap is placed over Vohsen's lamp, allowing the light to pass through the end of it. The lamp is placed under the inner angle of the orbit, and the limitations of the frontal cavity can be made out. A shadow will be manifest when the sinus contains pus, polypi or granulations.

The description of local treatment only is undertaken here; for the treatment of general diseases of which the sinus disease is only a part, the physician is directed to the appropriate section of this System.

THE MAXILLARY SINUS.

The Maxillary Sinus or Antrum of Highmore is the largest of the accessory cavities and that most frequently the seat of disease. The cavity is pyramidal in shape, with the apex situated in the malar process, and the base forming the outer boundary of the nasal fossa. The posterior limit is constant, being formed by the zygomatic fossa. The upper limit formed by the orbital plate, is also constant, but the anterior limit is variable.

The floor of the sinus is variable also; usually it is below the level of the floor of the nose (Fig. 2), but it may be higher or lower than this. This variability is of the greatest importance in determining the proper course of treatment to adopt in empyema of the sinus. The natural opening of the sinus is situated in the internal wall near to the orbital plate and about midway from front to back in the sinus. Its situation in the nasal fossa is in the middle meatus at the lower end of the infundibulum, thus allowing pus coming from the frontal sinus to flow into it should the infundibulum be gutter-shaped. The orifice is under cover of the middle turbinate bone, and it may be necessary to remove the anterior half of the bone in order to enter the sinus with a probe or cannula. The orifice is oval or round in shape and of the size of a crow quill. There may be, in addition, one or more accessory orifices owing to failure of the membranous parts of the internal wall to close developmentally. The membranous areas of the wall may be seen in the diagram (Fig. 3).

The maxillary sinus is more commonly the seat of suppuration than of any other affection owing to the teeth, but it must be remembered that it may be attacked by sarcoma or epithelioma, polypi, enchondroma, fibroma or mucous cysts. It may also be invaded by dentigerous or dental cysts and chronic hyperplasia of the alveolus (Fig. 4).

Suppuration in the maxillary sinus came into prominence about twenty years ago owing to the large number of cases met with as a result of epidemic influenza. It was no doubt owing to this that an impression was produced that the greater proportion of antral empyemata were caused by extension of disease from the nose.

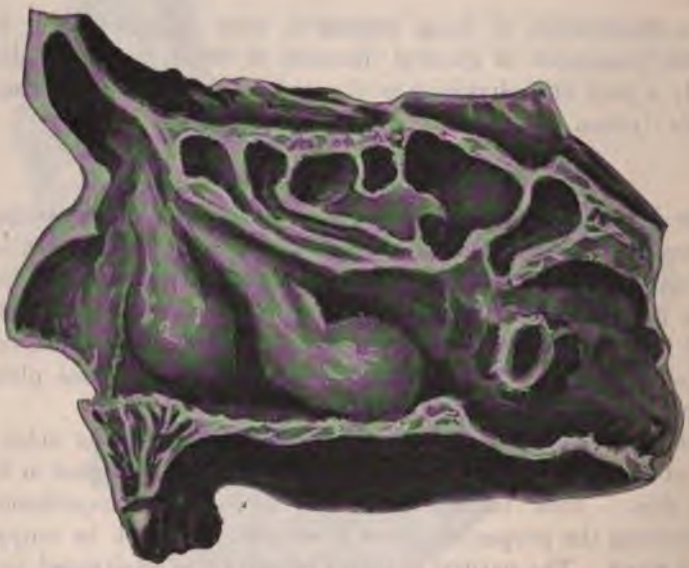

FIG. 6.—Sagittal section through the right nasal fossa, showing the basal plates of the ethmoid and hypertrophies arising from the uniform process of the ethmoid.

Since that time, however, dentists have discovered many cases arising from dental caries, peri-odontitis, and more particularly an alveolar abscess arising at the apex of a crowned tooth; the line of least resistance being into the antrum through the thin wall of compact bone limiting the sinus, or in other cases where the apex of the tooth root passes into the antral cavity itself. In my own experience, about 80 per cent. of cases are of dental origin. The other causes may be found in extension of disease from the nasal fossa in epidemic influenza, exanthemata, glanders, tuberculosis and syphilis. Cases arise also from fracture of the maxilla, a foreign body such as a bullet, or invasion by the larvæ of flies and insects. Suppuration of the sinus may occur from the application of the galvano-cautery to the nasal fossa above the level of the inferior turbinal bone.

The general treatment must be that of the particular disease of which the antral affection is a part. The local treatment will be directed to the evacuation of the cavity and the establishment of efficient drainage. With this object in view, the method of drainage must conform to the anatomical dimensions of the sinus. The diagnosis of suppuration must be established by following up the drop of pus appearing in the middle meatus. By bending the end of a nasal probe at a right angle for a distance of 1 centimètre and passing it upwards and outwards under the middle turbinal bone, about its centre, it will be found to engage in the natural opening. On withdrawing the probe it will have pus on the end of it. If a cannula bent in a similar manner is passed into the sinus it may be washed out with warm sterilised water, or a normal saline solution. After this, if pus is seen in the same situation, it cannot come from the maxillary sinus, but it may come from the frontal sinus or the anterior ethmoidal labyrinth. If the natural opening is blocked by polypi or hypertrophies (Figs. 5 and 6), granulations, or the excessive curvature of the middle turbinal bone, these must be removed by a cold wire snare or a punch forceps. The removal of the anterior half of the turbinal will usually be sufficient. If no entrance can be effected by the natural opening, the sinus may be entered by passing a strong exploring needle and syringe, or a trocar and cannula, into it through the inferior meatus. This is directed through the upper and back part of the meatus, well up under the inferior turbinal bone, passing the lower border of the bone about its middle. This position is selected because the posterior part of the sinus is constant, whilst the anterior is variable, and the inner wall of the antrum in the inferior meatus is membranous or of very thin bone. On applying suction with the syringe, or withdrawing the trocar, pus will be found, or in the case of hydrops antri, clear fluid. With the latter instrument the sinus may now be washed out, and the fluid may make its way out through the natural opening. The next day the process may be repeated by passing the cannula into the opening previously made. In some cases of recent or acute inflammation of the sinus, this procedure may be sufficient to effect a cure of the disease; but in long-standing cases, or in those of dental origin, simple lavage will not suffice; free drainage and curetting of the sinus will have to be adopted. Where there is no doubt that a tooth is the cause of the suppuration the removal of the tooth will be followed by a flow of foul-smelling pus. Alveolar drainage should now be carried out. The opening in the alveolus must be enlarged by a drill or carpenter's graduated gimlet, making a hole that will readily admit a lead pencil.

The second bicuspid or the first molar tooth, especially the palatine root, are most likely to be affected, then the first bicuspid and the second molar, the canine and wisdom teeth rarely. The limit of the sinus, anteriorly, is usually indicated by a line drawn vertically behind the canine tooth, but in a recent case at the Manchester Dental Hospital, where the right lateral incisor tooth was extracted for suppuration at the root, a probe introduced into the socket was found to pass backwards for a distance of 1½ inches into the maxillary antrum, which was full of pus. I have also drained the sinus through the socket of a wisdom tooth which communicated with it. It is important to ascertain which root leads into the cavity; if it is a buccal root the direction of the drill must be upwards and inwards, and if a palatine root, then it must be passed upwards and outwards, otherwise the drill may miss the antrum and pass into the canine fossa or the hard palate.

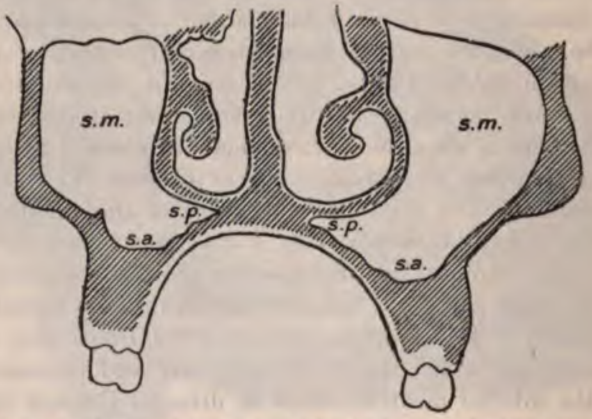

Fig. 7.—Double alveolar and palatal sinus of the Highmore cavity.
s.m., maxillary cavity; *s.a.*, alveolar sulcus; *s.p.*, palatine sinus.

When the pus is present and no tooth can be found at fault, there are three routes by which the sinus may be opened: (1) By the alveolus; (2) by the canine fossa; (3) by the inferior meatus.

The alveolar opening should be adopted if possible, because this is usually the lowest limit of the cavity; the older the patient the lower the level will be. In some cases the sinus turns in under the floor of the nose in a palatine sinus (Fig. 7). In such a case the opening in the internal wall cannot drain the cavity. The contra-indications for an alveolar opening are a deep alveolus with a high arched palate. An edentulous jaw is favourable, because there is a thin plate of compact bone only, the cancellous bone having become absorbed; this bone may be very hard to drill through.

The objections raised to the alveolar opening are that it is difficult to curette the sinus through the opening, that in old chronic suppuration there is a thickened unhealthy mucous membrane which must be removed to cure the disease, and that the sinus will go on discharging indefinitely.

To these arguments it may be replied that chronic cases will frequently yield to lavage and instillation of astringents and the cavity can subsequently be opened more freely by removing the outer wall of the alveolus, and the canine fossa, with punch forceps. One cause of failure is making too small an opening. The retention of the alveolar opening for too long a time will keep up discharge which seems interminable, but if the lavage of the sinus brings little muco-pus away, and there is only a small quantity found on removing the obturator, the opening may be gradually closed and the disease is cured. I have seen cases in which a tube had been worn for many months or years heal when a solid obturator was used and this gradually shortened.

After the opening has been made, and the sinus washed out, a rubber obturator, the thickness of a lead pencil (8 millimètres) with a flange base, is inserted. On the following day a model of the mouth is taken by a dentist, with the rubber post removed if the opening is fairly deep. This rubber post is left in and acts as a guide to the direction of the opening, if the latter is not deep.

From this model a small denture is made in vulcanite, the post being strengthened by a dental alloy pin. The denture can be fixed by clip bands attached to the two neighbouring teeth. If the patient wears a denture the post can be added to it. If it is painful to remove the post for a few days, this can be prevented by painting the wall of the opening with pure carbolic acid. When it is necessary to remove part of the outer wall of the alveolus a flange may be added to the denture to cover the opening. This method of making a solid post entirely prevents food and liquids from entering the sinus. With a tube in the opening, even if fitted with a cap, there is always the liability of food getting in, and this will keep up discharge indefinitely. Every morning and evening the denture must be removed and the sinus washed out with an alkaline antiseptic solution, such as : ℞. Acidi Borici, ℥ij ; Boracis, ℥j ; Sodii Chloridi, ℥j ; Olei Eucalypti, ʒj ; Acidi Carbolici, ʒj ; Misce. One teaspoonful to be added to a pint of warm water. The lotion should be used by means of a Higginson's or rubber syringe and tube, or a douche can, to the end of which a bent cannula or Eustachian catheter is attached. It is important, after irrigation, to blow in one or two syringefuls of air to displace all the lotion. When the irrigation is finished the cavity may be instilled with one of the following solutions : Nitrate of silver (2½ per cent.), argyrol or protargol (10 per cent.), hydrogen peroxide (B.P. solution), saturated solution of boracic acid in alcohol, or 2½ per cent. solutions of copper sulphate or sulphocarbolate of zinc. When the pus ceases to flow ⅛ inch may be sawn off the post, and this repeated twice a week until the sinus has healed. This usually takes from four to six weeks.

If this method is unsuitable an opening should be made in the canine fossa. The cheek being retracted, an incision is made in the mucous membrane, horizontally above the two bicuspids and the first molar. The bone is perforated with a chisel, stripped with a raspatory, and the opening enlarged with nibbling forceps sufficiently to admit the little finger. After examining the cavity with the finger the contents are removed with a curette, or spoon. The cavity is then packed with dry salalembroth or double cyanide ribbon gauze, or chloretone gauze ; any hæmorrhage may be arrested by packing the wound for a few moments with adrenalin gauze. This must be repeated each day, after washing out the cavity with the antiseptic solution as before. This procedure takes about the same time to cure the disease as the alveolar method, and may be combined with it. The third method of operating through the inferior meatus has the objection that the sinus is below the level of the floor of the nose, but it has the advantage that the buccal cavity is not in communication with the sinus which can be well packed with gauze after irrigation. In this operation it will be necessary to remove a part or the whole of the inferior turbinal body. Should the pus have entered the orbit it will probably return to the sinus, but on no account should the orbit be opened by operation from the front. I have seen two cases of blindness caused by pressure of pus entering the orbit which have recovered in a few weeks after draining the sinus.

New growths in the maxillary sinus will necessitate partial or complete removal of the maxillary bone. Complete excision of the bone for malignant disease is not attended by much success unless it is undertaken in the early stage of the disease. Benign tumours may be excised by informal operations to relieve deformity or pressure. Dental cysts arising from the end of a decayed fang may protrude into or fill up the antrum. On removal of the tooth clear fluid escapes, the cyst wall may be detached, or curetted, and the cavity packed.

A dentigerous cyst may simulate antral disease by bulging forward the canine fossa or it may invade the antral cavity (Fig. 4). In one case where a woman, aged forty years, presented all the symptoms of antral disease, an abscess was found invading the maxillary sinus with a non-erupted canine tooth lying horizontally in the sac. A boy, aged eight, had an antral abscess arising from a dentigerous cyst in which was lying horizontally the non-erupted second bicuspid.

The invasion of the maxillary sinus by bony tissue was described by me in the Dreschfeld Memorial volume. The condition is one of simple hyperplasia of cancellous bone produced by the irritation of carious roots of the teeth. The bone is embryonic in type and shows no sign of inflammation or malignancy.

If an incision is made along the alveolus and the gum stripped the bone can be completely gouged away and the cavity packed for a couple of days. After this, the mouth is simply rinsed out with a 1 in 40 phenate of soda solution after food. The space will fill up by granulation and the condition will not recur.

THE ETHMOIDAL SINUS.

The ethmoidal sinus or labyrinth is situated in the lateral mass of the ethmoid bone and consists of several cells, divided vertically by the basal plates depending from the cribriform plate of the ethmoid (Fig. 6). The first basal plate forms the bulla ethmoidalis, and separates the frontal cavity from the anterior ethmoidal cell. The middle turbinal bone forms the second basal plate and separates the anterior from the posterior ethmoidal cells. The third basal plate is the superior turbinal body and forms the posterior wall of the posterior ethmoidal cells. The anterior ethmoidal cells open into the middle meatus at the bulla and above and in front of the ostium maxillare, but the anterior cell may be inseparable from the frontal cavity or it may project into the frontal cavity, forming what is called a bulla frontalis. The other variations of the anterior cells need not be referred to here. The posterior ethmoidal cells open into the superior meatus, and may be of large size when a small sphenoidal sinus is present, and small when there is a large sphenoidal sinus. The development of the ethmoidal cells commences about the sixth month of fœtal life, but there is no ossification of the bony walls till after birth. Suppuration of the ethmoidal labyrinth is nearly always associated with the presence of polypi in the middle meatus and on the middle turbinal body. Where a closed empyema is present there will be no polypi, but a bulging of the orbital plate of the ethmoid may be observed.

The ethmoidal cells may be opened by breaking down the floor of the labyrinth with a hook, as recommended by Hajek, tearing forwards. Then with a cold wire snare, punch forceps, such as Hartmann's or Grünwald's, and a small spoon, the cells can be evacuated. More room will be obtained if the middle turbinal bone is cut away first of all. When the anterior ethmoidal cell runs up into the infundibulum or the frontal sinus it may simulate frontal sinus disease, and it may be necessary to open the floor of the frontal sinus at the inner angle of the orbit, and clear the cells from before backwards. The nose must subsequently be douched twice daily with the boric acid solution by means of a syphon nasal douche, and spraying with chloretone inhalant. Packing the nostril with gauze gives rise to a continuous dull headache, and the admission of air into the affected region assists healing. The after-treatment consists in punching away and scraping any tracks of pus that may be discovered. When opening up the posterior cells the middle turbinal bone must be removed and the cells broken down as before. The opening of the ethmoidal labyrinth from the orbit through the os planum cannot be recommended on account of inflammation being set up in the orbit.

THE FRONTAL SINUS.

The frontal sinus is situated between the layers of the frontal bone and may be said to be a continuation of the infundibulum, which corresponds externally with the inner angle of the orbit. The usual limitation above is the arcus superciliaris, extending outwards from the middle line, in an arched manner as far as the supra-orbital notch. It extends backwards, above the orbit for about half its distance. The two sinuses are separated from each other by a bony septum which may be vertical or diverge to one or the other side. The septum may be partly membranous, but there is no anatomical communication between the two sinuses. The dimensions of the sinus vary considerably in height and depth, one or both may be absent, or one may be large and the other small. The thickest wall is the anterior, the thinnest is the inferior or orbital, but the posterior is almost as thin.

The development of the frontal sinuses begins at the seventh year, and increases by separation of the two tables of the frontal bone.

The frontal cavity is much more frequently the seat of acute hyperæmia in acute nasal catarrh, and in such cases the pain may be relieved by applying hot fomentations over the root of the nose, or one or two leeches may be placed in the same situation. Luc (Paris) recommends constant nasal inhalations of mentholised steam. Internally, 5 gr. of calomel with a teaspoonful of effervescing sulphate of soda will relieve the congestion. This should be followed by 3-gr. doses of salicylate of quinine repeated every four hours till the pain subsides. In the closed empyema of the frontal sinus very severe symptoms are met with, the chief being intense frontal headache. In such cases all drugs fail, and immediate opening of the sinus is necessary in order to avoid the danger of suppuration breaking through the thin walls of the sinus into the brain cavity or the orbital fossa.

The frontal sinus is not often the seat of empyema alone, but on account of the close proximity of the anterior ethmoidal cells to the natural opening of the sinus they are generally found to be equally affected. Indeed, the natural opening of the maxillary sinus is so near the hiatus semilunaris that the sinus often becomes a reservoir for the discharges coming from the frontal cavity. In cases of chronic suppuration the antral trouble may first excite attention on account of the drainage of the other sinuses being free. The first thing to do in chronic frontal suppuration is to examine the infundibulum with a probe bent in a curved direction for a distance of 2 centimètres from its end upwards and outwards. After removal of the anterior end of the middle turbinal, the probe can be passed up the infundibulum into the frontal sinus. This can be done provided there is no obstruction from a projection of the anterior ethmoidal cell into the infundibulum, or the passage is not blocked by granulations or polypi. The probe is then replaced by a cannula similarly shaped, with a piece of rubber tube attached to the end, and the sinus washed out with the boracic acid solution, followed by air insufflation and instillation of one of the above-mentioned solutions. A stream of oxygen passed in through the cannula is useful. The lavage should be repeated each day and the nose douched by the patient twice a day in addition. Where the sinus is blocked by granulations or polypi, or the infundibulum is obstructed, it will be necessary to open the sinus from the front. It should never be attempted from inside the nose. The operation performed by Killian is the best, and leaves little or no trace afterwards. An incision is made along the margin of the orbit below the eyebrow, extending from the supra-orbital notch to the inner angle of the orbit, and curving downwards along the side of the nose to ¼ inch below the lower eyelid. The floor of the frontal sinus is then opened with a chisel and the sinus carefully examined with a probe in all directions. The upper edge of the wound being well retracted, the bone is again chiselled or drilled through, above the margin of the orbit, and afterwards gouged or nibbled away with forceps till the whole cavity is exposed. The infundibulum is then cleared down into the nose, and any anterior ethmoidal cells opened at the same time. The whole of the mucous lining of the sinus having been removed by curette and burr, the cavity should be swabbed out with a 5 per cent. solution of zinc chloride or pure carbolic acid and packed with chloretone or other gauze, the end being left out at the lower angle of the wound ; the outer part of the wound is sutured. Another plan is to pack a little gauze in the upper end of the sinus and to pass a drainage tube with one or two holes cut in it down the infundibulum into the nose, the upper end being left out of the lower end of the wound. The nasal cavity should be irrigated two or three times a day. There is a danger of diffuse spreading osteomyelitis in severe frontal cavity disease which, in spite of repeated operations, ends in cerebral abscess and death.

THE SPHENOIDAL SINUSES.

The sphenoidal sinuses are situated in the body of the sphenoid bone and vary very much in size ; they may be divided by a septum from the rostrum, or there may be one cavity. The septum is often much deflected, causing an unequal size in the two cavities. The natural opening is found in the anterior wall at its upper part. The thinnest wall is the anterior one ; the upper cranial wall is next in thickness, and, if the cavity is deep, it is placed beneath the sella turcica and the cavernous groove. The body of the pre-sphenoid becomes hollowed out about the sixth year.

The sphenoidal sinus is sometimes the seat of empyema, either alone or in association with the posterior ethmoidal cells. In order to examine it it will be necessary in most cases to remove the middle turbinal bone, but if the fossa is large and the turbinal small the orifice can be seen. It can be entered by a probe from the anterior nares passing in a line backwards and upwards from the anterior nasal spine across the centre of the middle turbinal. A cannula directed in the same way will enable the sinus to be irrigated and this should be done daily. The only operation to be performed on the sphenoidal sinus is to break down the anterior wall with a strong hook, or to use a special punch forceps, then to scrape out the sinus with a sharp spoon. If a sequestrum is present it must be removed.

F. H. WESTMACOTT.

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DISEASES AND AFFECTIONS OF THE NASO-PHARYNGEAL CAVITY.

HYPERTROPHY OF THE PHARYNGEAL TONSIL (ADENOID VEGETATIONS).

THE lymphoid or adenoid tissue of the naso-pharynx is grouped chiefly on its vault and posterior wall, forming the pharyngeal or Luschka's tonsil, which is similar in structure to the other tonsils. It is constantly present in the child and tends to disappear towards puberty. It is liable to the same morbid changes as the other tonsils and to its chronic hypertrophy the term "adenoid vegetations" has been applied. This is a common affection which may be met with even in infants, but it is more usually between the ages of two and six that symptoms first attract attention. The hypertrophy may persist even after puberty, giving rise to naso-pharyngeal catarrh and ear affections. Though the vault and posterior wall is the chief seat of the hypertrophied tissue it may be generalised, filling the recesses and occupying the greater part of the naso-pharynx. On the other hand, it may form a circumscribed mass confined to the middle line.

As the question of treatment is largely determined by the presence of certain symptoms it will be necessary to refer briefly to these. The symptoms produced by hypertrophy of the pharyngeal tonsil are explained by its anatomical position and may roughly be classed as those of obstruction and those of infection, the former being due to the presence of a mass behind the nose blocking the nasal airway and interfering with its secretions; the latter to its proximity to the Eustachian tubes giving rise to aural trouble. Accordingly, the most prominent symptoms are nasal obstruction and its consequences, such as difficulty of breathing through the nose, mouth breathing, increased mucous discharge from the nose, altered facies with the narrow nostrils, open mouth, ill-developed upper jaw, high arched palate and stupid vacant expression to which the term "adenoid facies" has been applied. The voice is toneless and attacks of deafness are common. Spasmodic cough is often present with tendency to bronchial catarrh and the chest is badly developed. The general health of the child suffers, various nervous manifestations are not uncommon and there may be a general arrest of development. The term "adenoid facies" is an unfortunate one, implying as it does a condition peculiar to adenoid vegetations, whereas it is but evidence of nasal obstruction which may, of course, be due to other affections. Thus deflection of the nasal septum, hypertrophy of the anterior and posterior ends of the turbinals, atresia of the choanæ, alar collapse, etc., are conditions which produce a similar change. Accordingly a careful examination both by nasal speculum and posterior rhinoscopic mirror is essential. Digital exploration is largely employed to ascertain the presence and size of adenoid vegetations, but it is not always quite satisfactory. It fails to give information about small adenoids the seat of lacunar disease, though it is in this condition that some of the most striking results are obtained by removal. A careful differential diagnosis is therefore of importance. Any of the conditions mentioned above may coexist with adenoid vegetations, and the question of including them in any operative procedure should be considered, inasmuch as any operation for adenoids alone may fail to produce the desired result.

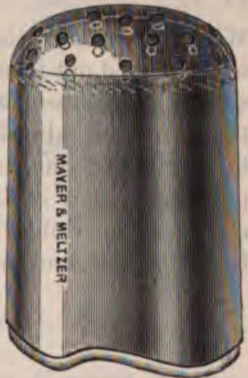

FIG. 1.—Silk's celluloid mask.

With regard to treatment, when chronic hypertrophy of the pharyngeal tonsil is established then nothing but its removal by surgical means is of any value. Acute enlargement is, of course, amenable to medical treatment as is also the subacute inflammatory attack to which a chronically enlarged tonsil is subject. The use locally of mild alkaline washes through the nose, the administration of tonics, cod-liver oil, etc., and a change to a dry bracing climate are of service in subduing the attack, but when the structure is permanently enlarged recovery is only partial and the operation for removal is the simplest and most effectual. The practitioner may be guided in this decision by certain indications. The existence of nasal obstruction and its effect upon the development of the face and chest, the occurrence of ear affections and constitutional disturbance and generally the persistence of the characteristic symptoms, all point to the necessity for the removal of adenoid vegetations as early as possible. This may be done at any age, even in infants at the breast, if the symptoms are urgent, though if feasible, it is better to wait until a little later. Good results are obtained in operating before the seventh year before permanent changes in the face set in.

Question of Anæsthetic.—Whereas on the Continent the operation is rarely carried out under a general anæsthetic, in this country it is almost never, except in very young infants, done without one. Local anæsthetics in children are not free from danger and in the adult are usually insufficient. As it is of the utmost importance that the operation should be done thoroughly and completely, a general anæsthetic is desirable. Its form will depend upon the practice of the individual operator or anæsthetist.

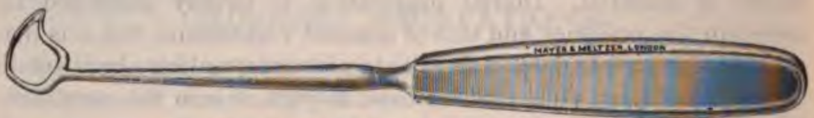

FIG. 2.—Beckmann's post-nasal curette.

Whatever anæsthetic is employed it ought to enable the operation to be carried out in a proper manner. No anæsthetic is specially suitable for the operation *per se*. It can be done under any of those in habitual use and the operator should give the preference to which he considers the safest. The risk of the operation is practically that of the anæsthetic. From the number of deaths recorded under chloroform in this operation, that anæsthetic is not free from risk and ought, perhaps, to be confined to special cases.

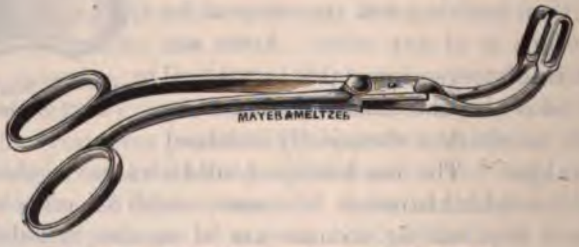

FIG. 3.—St. Clair Thomson's post-nasal forceps.

Nitrous oxide and ethyl-chloride give a short anæsthesia in which an experienced operator may do all that is necessary, but there is a distinct advantage in having a longer period than these afford. The mixture of chloroform and ether, in the proportion of chloroform, 1 or 2 parts, and ether, 3 parts, given on a Silk's mask (Fig. 1), is an excellent anæsthetic for children. The writer's experience gives preference to pure ether alone, or ether preceded by a small measured quantity of ethyl-chloride to avoid its disagreeable initial effect. The procedure is very simple. The anæsthetist takes a Rendle's or Silk's mask lined with flannel and containing a sponge.

Over the sponge is placed a small piece of loose gauze upon which not more than 1 c.c. of ethyl-chloride is sprayed. The mask is now applied, closely fitting over the nose and mouth. A few respirations suffice to render the patient unconscious. As the object of the ethyl-chloride is simply to do away with the disagreeable sensation of the ether and not to produce full anæsthesia the gauze with the ethyl-chloride is removed when slight snoring sets in, and pure ether poured on the sponge. If the transition to ether causes the patient to hold the breath the mask may be removed for a moment until regular breathing is established. The ether should be pushed until the superficial reflexes are abolished. A good test for this purpose is pinching the skin on the inner side of the thigh, the conjunctival reflex in the child being very misleading. When the patient is well under, the operation may be begun and completed before signs of coming out appear, though if necessary, the administration may be resumed at any stage. For adults a Clover inhaler may be employed. The writer has used ether in these operations for many years in patients of all ages, except very young infants, and is amply satisfied with the feeling of safety it gives. He has never seen any ill-effect even in children prone to bronchial catarrh. As to alleged disadvantages, cyanosis need not occur and free secretion of mucus should not interfere with the operation if the patient is on the side.

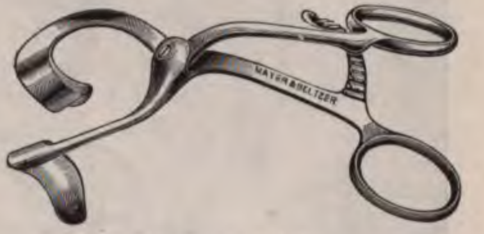

FIG. 4.—Doyen's gag.

Instruments.—Most operators now use the Gottstein curette in one of its forms, that of Beckmann being perhaps the best (Fig. 2). It is well to have two sizes, the medium and the small. The addition of a cage to the curette as suggested by St. Clair Thomson ensures immediate delivery of the adenoid mass. The post-nasal forceps modified by St. Clair Thomson is most useful for removing small pieces around the ear tubes (Fig. 3). Doyen's gag is a very convenient form (Fig. 4). A tongue depressor and dressing forceps complete the list.

Operation.—The child is placed on a table near a window with a good light and so arranged that the light falls into the pharynx when the mouth is open. A forehead mirror is of great assistance in illuminating the parts. The head rests on a low firm pillow and the surgeon stands on the patient's right. When the patient is sufficiently under the anæsthetic, the gag is inserted on the left side of the mouth, which should not be opened too widely, as it tends to stretch the faucial pillars and interfere with the manipulation of the curette. The anæsthetist taking charge of the head, holds it slightly turned to the right (Fig. 5). When enlarged mouth tonsils are present it is convenient to remove them first. Having depressed the tongue with a spatula, a Mackenzie guillotine held in the left hand is applied over the right tonsil and pressed firmly outwards, counter-pressure from the outside being exerted by the anæsthetist. In this way the tonsil is forced into the lumen of the guillotine and the right hand, dropping the spatula, is made to drive the blade home. The left tonsil is then removed in a similar manner by holding the guillotine in the right hand. If the patient is turned more on the side, the blood runs into the dependent right cheek

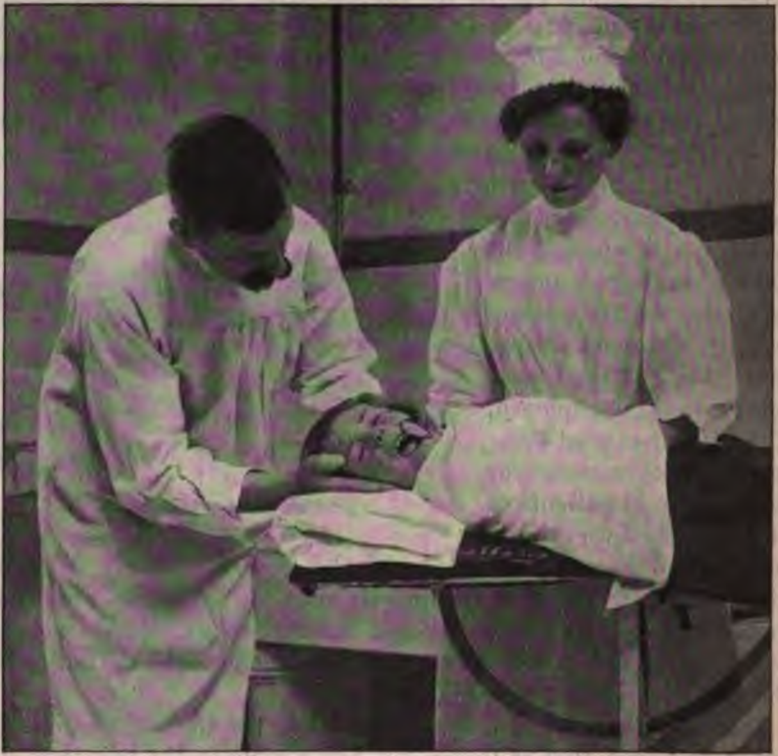

FIG. 5.—Position of patient, anæsthetist, and nurse at commencement of operation.

and escapes. The surgeon then proceeds to remove the adenoids. Depressing the tongue with the left hand and holding the curette in the right like a pen, he introduces it behind the soft palate and pushes it upwards and slightly forwards until it is felt to touch the roof of the naso-pharynx just behind the vomer. Keeping the instrument strictly in the middle line it is now made to act as a guarded knife rather than a curette. It is firmly pushed, first slightly upwards and backwards, and then describing the arc of a circle is carried with a sweep downwards, so as to cut away the whole mass of growth, which falls into the pharynx. This movement enables the vault of the naso-pharynx, which forms the segment of a circle, to be traversed in one clean sagittal sweep. A smaller sized curette is then passed and the parts slightly to each side of the middle line swept in a similar manner. The left forefinger is now introduced behind the soft palate and the fossæ of Rosenmüller and the recesses about the Eustachian tubes examined. Any remains of adenoid tissue are curetted with the finger nail and removed by post-nasal forceps under the guidance of the finger. Loose tags of tissue in the pharynx are pulled off with dressing forceps. Bleeding usually gives no anxiety with the patient on the side. Swabbing the throat is undesirable, as it is apt to bruise the parts and cause discomfort afterwards, and unnecessary, as depressing the right cheek with the finger enables the blood to run out unhindered. Hæmorrhage soon ceases. Attention should be directed to the vault of the naso-pharynx just behind the vomer and to the recesses where small pieces are apt to be left.

The patient is put to bed and given nothing for some hours. He is confined to bed for two days and restricted to soft food. On the third day he may be allowed up in his room, and at the end of a week may resume his daily life. Local treatment is unnecessary. Sucking ice is useful if the throat is painful. Nasal catarrh and deafness usually disappear in a week or ten days. To assist in establishing nasal respiration the child may be taught simple breathing exercises through the nose, and if deafness does not disappear, the Politzer bag may be used cautiously. The risk of the operation is very slight. General septic poisoning has been known to follow as the result of defective general hygienic surroundings.

The result of the operation in uncomplicated adenoids is excellent. The improvement in the child is generally immediate and very striking.

With regard to recurrence, this is very rare after a thorough operation under a general anæsthetic. An incomplete operation may leave pads of adenoid tissue on the roof of the naso-pharynx which enlarge and lead to return of the old symptoms. Occasionally when the operation is done under three years of age recurrence takes place when the child is attacked by one of the exanthemata. On the other hand, in spite of thorough operation, cases are met with in which many of the symptoms persist. Though this is often due to the co-existence of other causes of nasal obstruction, yet, apart from that, a certain proportion of children do not return to the normal and always remain somewhat stuffy.

D. R. PATERSON.

NASO-PHARYNGEAL CATARRH.

Naso-pharyngeal Catarrh may present itself in acute or chronic form. The former in the adult is almost invariably secondary to acute coryza and may form part of a general catarrh affecting the whole upper respiratory tract. In the child it is usually associated with enlargement of the pharyngeal tonsil or adenoid vegetations. Chronic naso-pharyngeal or post-nasal catarrh may result from an acute attack which is apt to linger on account of the difficulty of expelling the secretions from the recesses of the naso-pharynx, and which may also be kept up by dust inhalation, the excessive use of alcohol and tobacco, defective hygienic conditions, etc. In most cases, however, it is chronic from the first, being found associated with similar inflammation in the nose and lower pharynx. Though only part of a general pharyngitis, it is perhaps the most important from the patient's point of view, as it is usually the discomfort arising from hawking and scraping the secretions from the naso-pharynx which compels him to seek advice. The affection is often secondary to conditions in the nose, such as various forms of rhinitis, nasal obstruction from septal deformities, etc., or purulent discharges from the accessory sinuses, which, passing into the naso-pharynx, prove troublesome to expel. It may take the form of simple catarrh with muco-purulent secretion scattered about the space; in others there is a tendency to dryness of the posterior wall and a glazed appearance of the mucous membrane with adherent crusts, a condition often associated with atrophic rhinitis and a similar state of the lower pharynx. In some cases it is related to an affection of the pharyngeal tonsil which has undergone incomplete atrophy, and is the seat of chronic lacunar disease with muco-pus discharging from the median recess or so-called bursa.

In the treatment of naso-pharyngeal catarrh it is of prime importance to find out the condition to which it is secondary. It is a matter of common experience to find that the apparent incurability of such a catarrh is due to the primary condition being overlooked. A careful posterior rhinoscopic examination is therefore essential in all such cases. This may reveal a trickle of pus from an accessory sinus with the treatment of which the obstinate naso-pharyngitis vanishes. The removal of a nasal obstruction by appropriate surgical measures often of itself cures the condition; in any case, it would be necessary for carrying out the primary indication in the treatment of all naso-pharyngeal catarrh, viz., thorough cleansing of the naso-pharynx through the nose. This is best done by the use of a suitable wash passed through the nostrils into the naso-pharynx. A simple glass douche or rubber ball syringe may be employed, no force being used, as secretions may be driven into the ear tubes, and set up middle ear infection. The patient, holding the head well back and keeping the mouth closed, permits a few drops at a time to escape through the nostrils into the throat. A warm solution of an alkaline salt is the best as it loosens and dislodges the secretion into the throat from which it may be spat out. Experience has shown that solutions of bicarbonate of soda in the proportion of 7 gr. to the ounce, borax, 10 gr. to the ounce, and chloride of sodium, 3 to 5 gr. to the ounce, agree best with the nasal mucous membrane, as they are isotonic with the blood serum. A spray does not, as a rule, furnish a sufficient stream to wash crusts away. The addition of glycerine to the alkaline solution in the proportion of half a teaspoonful to the ounce is very helpful in the dry form, as is also a solution of menthol, 10 gr. to the ounce of liquid paraffin in the form of a spray. The special syringes designed for the naso-pharynx are of little or no value. Such a cleansing process is indispensable for the treatment of all cases of naso-pharyngeal catarrh and is often all that is necessary. Of astringent solutions the nasal mucous membrane is very intolerant. The same may be said of antiseptics except in extreme dilution, and it is questionable if even the mild ones present in washes which are now fashionable are not more harmful than otherwise. It should be borne in mind that the natural secretion which keeps the nose clean is the nasal mucus, and the nearer a solution approximates to it the more comforting it is to the patient. On the other hand, in obstinate cases where there is

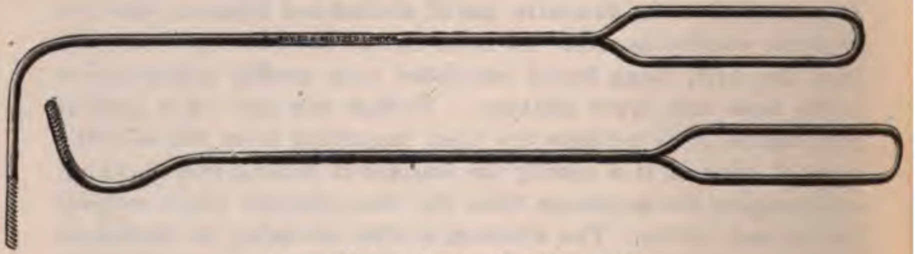

FIG. 1.—Naso-pharyngeal wool carriers.

thickening and congestion of the mucous membrane, and the secretion is abundant, brushing the naso-pharynx once a week with an astringent solution by means of a short-curved naso-pharyngeal wool carrier is very valuable (Fig 1). A little wool twisted around the probe and soaked in the solution is passed up behind the soft palate and rubbed over the parts. Chloride of zinc in varying strengths from 10 to 30 gr. to the ounce, and nitrate of silver (15 to 30 gr. to the ounce), are most suitable. In the dry form with tendency to crust formation, solution of iodine in glycerine applied in increasing strength and in a similar manner twice a week is of great service. The formula generally employed is iodine, 5 to 10 gr.; potassium iodide, 10 to 30 gr.; oil of peppermint, 5 min.; glycerine, 1 oz.

Where catarrh is associated with and kept up by disease of the pharyngeal tonsil or bursa surgical treatment is called for. Under a general anæsthetic the remains of the tonsil in the naso-pharynx should be thoroughly removed with a Gottstein curette. This has an excellent effect.

With regard to general treatment it is essential that all injurious influences should be avoided. A stay in a dry, bracing inland atmosphere where the air is comparatively pure and free from dust and chemical impurities often suffices to effect a cure in intractable cases. The mode of life should be rightly ordered. Regular exercise should be taken in the fresh air, if possible, and heated rooms avoided. The application of cold water to the skin followed by friction and, if well borne, cold baths and even sea bathing are valuable adjuncts in the treatment. Alcohol, especially in a concentrated form, is deleterious, and tobacco tends to keep up chronic catarrh, more especially when cigarettes are much indulged in. As there is a close relation between digestive and liver troubles and this affection, attention to them is necessary. Alkaline and sulphur waters have a beneficial effect, and a sojourn at a spa, such as Harrogate, Strathpeffer or Llandrindod, is often very helpful. When anæmia is present, especially in women, the administration of some mild form of iron is indicated.

D. R. PATERSON.

LUPUS AND TUBERCULOSIS OF THE NASO-PHARYNX.

Lupus.—As lupus tends to spread downwards from the nares to the pharynx and larynx, its occurrence in the naso-pharynx is naturally fairly frequent. The lesions are usually seen on the upper surface of the soft palate and on the posterior ends of the turbinals.

The treatment is the same as that of lupus of the pharynx and larynx, namely, an open-air *régime*, the administration of arsenic and destruction of the nodules with the galvano-cautery under inspection with the rhinoscopic mirror.

Tuberculosis.—It is not unlikely that tubercle bacilli can pass into the lymphatic system through the naso-pharyngeal tonsil, as through the faucial tonsils, without causing any obvious local lesion, and tubercles and bacilli have been found in adenoids removed from ordinary cases in a percentage which varies greatly according to different observers. Clinically, however, tuberculosis of the naso-pharynx, as distinct from lupus, is most exceedingly rare. The writer has reported[1] the case of a boy, aged seventeen, with pulmonary tuberculosis affecting both upper lobes, who showed a large tract of superficial ulceration extending from the naso-pharyngeal tonsil down the posterior pharyngeal wall to the leve of the larynx, which was itself unaffected. The severe dysphagi was relieved and the ulcer reduced in extent by curettage.

Treatment consists in keeping the naso-pharynx clean b nasal syringing with a warm alkaline lotion, such as bicarbonat of soda (gr. 3), borax (gr. 3), carbolic acid (gr. 1), glycerine (dr. 1 water to 1 oz., and in relieving dysphagia with insufflations o orthoform, applications of silver nitrate, and scraping of the ulcer on the principles recommended in the treatment of Tuberculosi of the Pharynx.

HAROLD BARWELL.

REFERENCE.

[1] Trans. Brit. Laryngol., Rhinol. and Otol. Assoc., 1906—1907, p. 49.

SYPHILIS OF THE NASO-PHARYNX.

Local Treatment is not required during the earlier stages of the disease. In the tertiary stage ulceration with purulent discharge demands cleansing by one of the methods recommended in dealing with nasal syphilis (*q.v.*), while this is also necessary for the removal of crusts which tend to accumulate, especially at a late period, when the mucous membrane of both the nose and the naso-pharynx has become markedly atrophic. Very rarely sequestra of the upper cervical vertebræ or the basisphenoid require removal, but this should not be attempted until they have become quite loose.

T. GUTHRIE.

DISEASES AND AFFECTIONS OF THE UVULA.

DEFORMITIES OF THE UVULA.

The uvula may be bifid or cleft, or the azygos uvulæ may be split, without a division of the mucous membrane. These conditions are due to the same causes which produce cleft palate and may be associated with the latter. They are anatomical abnormalities and do not give rise to symptoms, neither do they require treatment. Absence of the uvula is generally a result of some previous disease, such as old syphilitic ulceration, or it may be due to traumatism, as when the body has been caught in an adenoid curette.

ELONGATION OF THE UVULA.

The uvula may hang low, so that it touches the back of the tongue or even irritates the larynx. This may be due to (1) elongation of the uvula itself, (2) laxity of the palate, causing it to drop. These two conditions are often associated.

The undue length of the uvula may cause an irritating cough, and when this symptom is associated with general relaxation of the parts, local treatment should be employed, *i.e.*, painting with glyc. acid. tannici., krameria lozenges, and general constitutional treatment, with the avoidance of irregular hours, alcohol and tobacco is necessary. If the elongation is productive of symptoms such as cough, it should be removed.

The uvula is rendered anæsthetic with 10 per cent. cocaine and its tip is grasped with a pair of volsellum forceps. The redundant portion is then cut off with a pair of scissors curved on the flat, care being taken not to put much traction on the uvula while cutting it through, lest a conical stump with protruding muscle should be left and healing delayed. Some operators pass a suture through the mucous membrane and tie it so as to close the wound. The uvula should not be cut off flush with the palate, but only the redundant portion removed.

A tannic acid gargle and sucking ice may be of service if bleeding occurs. Hæmorrhage is usually slight, but occasionally there is a considerable amount, and in this event the cautery should be applied to the spot. If this fails, a suture should be passed through the stump.

TRAUMATISM OF THE UVULA.

The traumatisms of the uvula are usually associated with operations. Thus the uvula is sometimes cut off or lacerated by the adenoid curette or tonsillotome. If the uvula is nearly severed it is best to complete the removal, but a laceration if left alone will usually heal readily. Apart from laceration, the uvula may become bruised and œdematous after removal of the tonsils, and especially so where the pillars of the fauces are separated from the tonsil as in performing enucleation. This condition, as a rule, requires no treatment, as it soon subsides.

AFFECTIONS OF THE UVULA.

Œdema of the uvula is found occasionally by itself as a result of inflammation, but more frequently in association with septic conditions of the tonsil or palate, such as acute pharyngitis or acute tonsillitis. Thus, it is frequently found in cases of peritonsillar abscess or quinsy. An œdematous uvula occurs by itself in middle-aged persons addicted to alcohol and tobacco in excess, while pyorrhœa alveolaris is sometimes an added factor in such cases.

If the œdema of the uvula is marked the patient experiences the feeling of a foreign body in the throat, which he tries to cough out. The œdematous mass swings to and fro with respiration, which it may also embarrass if very large. Should this occur free incision should be made into the uvula.

The uvula usually recovers, but may become gangrenous, and this may be associated with oral sepsis, or occur as a terminal event in acute lymphatic leukæmia.

When **acute inflammation of the uvula** is associated with an acute infective process in the pharynx, fauces or palate, the treatment of the uvula consists of the general and local treatment of the infective process.

The uvula may be the seat of **tuberculosis**, but usually the palate also is involved. In advanced cases of pulmonary tuberculosis small tubercles appear on the uvula and palate. These break down and form one or more ulcers which are tender and painful. This form of tuberculosis usually occurs as a terminal infection. **Lupus** of the pharynx, fauces or palate similarly may involve the uvula.

For the relief of the painful tuberculous ulcer painting the parts with 10 per cent. cocaine may be employed if the patient is unable to swallow. The application of equal parts of orthoform and anæsthesine also gives relief. The treatment of the chronic lupoid form of tuberculosis consists of local curetting and the administering of tuberculin, results of which are frequently very good.

The treatment of syphilis, glanders and diphtheria involving the uvula require no special mention.

BENIGN GROWTHS OF THE UVULA.

These are papillomata, fibromata and angiomata.

Benign growths, especially if large or pedunculated, are apt to cause symptoms of tickling in the throat, cough, and even vomiting. When growing from the tip of the uvula they are often associated with an elongation of this organ. Treatment consists in grasping the tumour in suitable forceps and cutting out the pedicle with curved scissors. In dealing with cavernous angiomata the operator should be prepared for the possibility of hæmorrhage.

MALIGNANT DISEASE OF THE UVULA.

The uvula may be the seat of squamous carcinoma. In the case of an ulcer with indurated base, diagnosis may have to be made from a primary chancre, or, as in a case published by Milligan of a man aged sixty-two, with an indurated and enlarged uvula, the ulcer may be on the posterior surface of that body extending on the dorsal surface of the soft palate. A posterior rhinoscopic examination should be made in order to avoid the possibility of such a condition escaping notice.

Treatment consists in removing the uvula and most of the soft palate by operation.

G. SECCOMBE HETT.

DISEASES AND AFFECTIONS OF THE TONSIL.

ACUTE TONSILLITIS.

ACUTE TONSILLITIS is due to infection of the tonsils with organisms, notably staphylococci, streptococci and pneumococci, and may be classified as follows:

(1) Acute lacunar tonsillitis; (2) Acute Parenchymatous tonsillitis; (3) Ulcerative tonsillitis; (4) Peritonsillitis.

In acute lacunar tonsillitis there is reddening and swelling of the tonsils; discrete yellowish-white patches appear over and around the mouths of the lacunæ. If one or more of the lacunæ become obstructed an intra-tonsillar abscess may form.

Acute parenchymatous tonsillitis is sometimes uni-lateral. It is characterised by great swelling and reddening of the tonsil. The attack subsides from the third to the sixth day, but frequently leaves a chronically enlarged tonsil. An intra-tonsillar abscess may form.

Ulcerative tonsillitis occurs in three forms: (1) Hospital sore throat; (2) Acute septic ulceration; (3) Vincent's angina. The hospital sore throat occurs as small multiple ulcers, found on the tonsils of anæmic persons working amid unhealthy surroundings. There is usually no marked constitutional disturbance. Acute septic ulceration occurs as a complication of a severe attack of streptococcus tonsillitis. The ulcer is well defined, with sloughy base and hyperæmic edge. In Vincent's angina there is an ulcer with a grey or yellow slough, which is soft and leaves a bleeding surface on removal. Extensive ulceration of the palate and the fauces may be added. There is great constitutional disturbance and enlargement of the cervical glands in this form, which is produced by a fusiform bacillus and a spirillum.

Peritonsillar abscess or quinsy usually occurs as a complication of an acute lacunar tonsillitis. There is increased pain of a throbbing character on the affected side, and the local and general symptoms, which had begun to subside, become worse and the temperature gets higher.

A swelling appears to the outer side of the upper part of the tonsil, *i.e.*, in the pericapsular space. The tonsil is pushed towards the middle line; the uvula becomes œdematous, and is also pushed over. The abscess often ultimately points and bursts at the usual site of surgical interference, but the patient's sufferings should be cut short, and risk averted by not waiting for this.

Prophylaxis.—In people subject to acute tonsillitis the general health should be attended to, and hygienic conditions should be insisted on, as regards methods of life, fresh air and sanitary surroundings. Local causes of infection should be treated, especially carious teeth and pyorrhœa, as oral sepsis is a frequent and often overlooked cause of tonsillitis.

If necessary, to prevent future attacks, the tonsils should be removed.

General Treatment.—Rest in bed and fluid nourishment is indicated. At the commencement of an attack a purgative is generally advisable and subsequently the bowels should be kept well open. Tincture of ferric chloride (♏20 [U.S.P. ♏15] combined with chlorate of potash and taken every four hours) is the best medicine. Also aspirin (given in 10-gr. doses three hourly) will help to relieve pain.

Local Treatment.—Bicarbonate of soda gently rubbed on the tonsils at frequent intervals relieves the pain, or a hot alkaline spray may be employed for the same purpose; one application of silver nitrate (gr. 30, ad ℥j) is recommended as an attempt to abort the attack.

Formamint tablets are useful, but gargles should not be employed. An antiseptic mouth-wash should be used, such as listerine, and as a local application to the tonsils, resorcin (ʒj, ad ℥j), equal parts of guaiacum and sterilised oil, a 4 per cent. solution of protargol or 2 per cent. Izal are to be recommended.

In the early stages cold applications to the neck, combined with local antiseptics, are sometimes used to attempt to abort the attack; while later on, fomentations relieve the pain.

If dysphagia is distressing, painting the tonsil with 10 per cent. cocaine will relieve the pain and allow nourishment to be taken. Pressing the auricles with the palms of the hands and lifting them when swallowing allows this to be more comfortably accomplished. Should an *intra-tonsillar abscess* form, as may happen in parenchymatous tonsillitis, or from the obstruction of a crypt in lacunar tonsillitis, evidence of this condition is shown by the surface of the tonsil becoming tense, while the pain increases and there is throbbing. The tonsil should then be incised and the pus evacuated. A *peri-tonsillar abscess* should be opened directly the bulging of the palate confirms the diagnosis. If the palatal tissues are very brawny, the incision may be made by a bistoury, sinus forceps being then introduced and widely opened so as to make a free opening into the peri-tonsillar space. If the pus is near the surface the sinus forceps should be thrust in and then withdrawn widely open, without making any preliminary incision.

The operation is usually done after anæsthetising the parts with 10 per cent. cocaine ; but if the patient is very nervous, gas may be employed, care being taken to mop the pus away so that it does not pass into the larynx. A headlight, or forehead mirror with reflected light, should be employed and the opening made in a line with the base of the uvula and external to and parallel with the anterior pillar of the fauces.

The progress in ordinary acute tonsillitis is good. The rare complications are endocarditis, otitis media, orchitis and ovaritis. Pus in the peritonsillar space should be evacuated immediately it is diagnosed, as the abscess may burst and cause death from asphyxia or from septic pneumonia if left untreated. Ulceration of the deep vessels with death from secondary hæmorrhage, and mediastinitis owing to the pus tracking downwards into the thorax, has occurred from neglect of proper treatment.

G. SECCOMBE HETT.

CHRONIC INFECTIONS OF THE TONSIL.

Chronic infection may follow an acute attack or be a sequela of an acute specific illness. It may also come on gradually and often causes chronic enlargement of the tonsil without any history of acute infection.

Clinical types.—(1) The enlarged tonsil. (*a*) The projecting tonsil. In this form there is an enlargement of the free portion of the tonsil, so that the latter projects between the pillars into the pharynx. The enlargement may be mainly due to overgrowth of the lymphoid tissue, in which case the tonsil is soft and friable, or to increase of the connective tissue elements, when it is hard and tough. Frequently there is an increase in both elements, one of which predominates. (*b*) The embedded tonsil (Fig. 1). The proliferation, especially in young children, may be limited to the

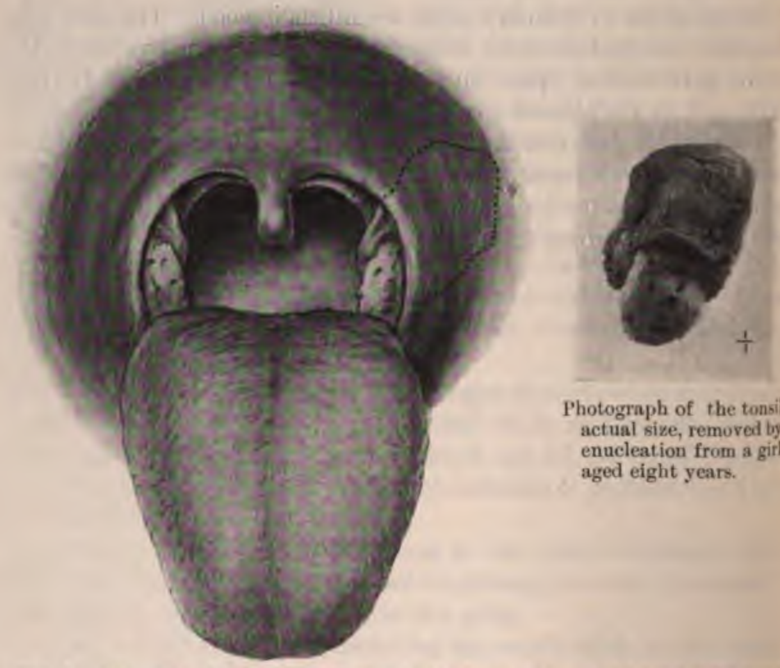
Photograph of the tonsil, actual size, removed by enucleation from a girl aged eight years.

Fig. 1.—The embedded tonsil in relation to the fauces (from a girl aged eight years).

embedded portion of the tonsil (pars palatina). The tonsil in these cases does not necessarily project from between the pillars to any great extent, but two large rounded swellings appear in the palate, on making the child gag. (*a*) and (*b*) are sometimes combined, so that the tonsil projects markedly into the pharynx and has also a large embedded part. 2. The small septic tonsil. The tonsil may not enlarge, as the result of infection, but the lacunae may be mainly affected and be filled with evil-smelling caseous pus. In adult life the tonsil may have undergone atrophy, or have been removed with the guillotine, so that there is little lymphoid tissue left, and yet the remains of a few septic crypts keep up a chronic tonsillitis.

General Treatment.—This consists in improving the condition of the patient and thus increasing his power of resisting infection, and, if necessary, in removing the tonsils. Change of air and surroundings, preferably to a bracing seaside resort, with the administration of internal remedies, such as iron or cod-liver oil and maltine, is to be recommended.

OPERATIVE TREATMENT.

Tonsils should be operated upon in cases of chronic tonsillitis where general measures have failed. Also in (1) recurrent acute tonsillitis or peri-tonsillar abscess; (2) where the tonsils are acting as a source of infection, as in cervical adenitis, suppurative otitis media, etc.; (3) where the tonsils are markedly enlarged.

Galvano-cautery.—This consists of burning under cocaine at successive sittings, with the object of replacing the lymphoid tissue by cicatricial tissue. This method is slow, tedious, uncertain and often ineffective, as attacks of tonsillitis often occur in the remains of lymphoid tissue and sealed-up crypts. It should be reserved for those cases which are unsuitable for an anæsthetic, or for those patients who refuse more radical measures.

Morcellement, or removal by means of tonsil-punch forceps, is employed either alone or combined with the cautery, and is in some cases efficient. It can be done under cocaine, but is open to the same objections as the above.

Removal by the Guillotine.—This method should be used for tonsils which are enlarged and have most of their bulk projecting between the pillars. It can be done under cocaine, but if adenoids co-exist a general anæsthesia should be employed. Many methods of anæsthesia are in vogue, but perhaps the most satisfactory is a light anæsthesia with the A.C.E. mixture. The patient lies on his back, with the head slightly over the end of the table, or else in the lateral position. The mouth is gagged open and an assistant presses the tonsils inwards by pressure on the outside of the neck. The guillotine (Fig. 2) is introduced and pressed outwards so that the tonsil engages the ring of the guillotine, and the blade is then pressed home. Bleeding is free but not often serious, and soon stops. Should severe bleeding occur the patient is kept under by means of a Junker's inhaler, and after mopping out the throat the bleeding point is sought for, clamped, and, if necessary, tied. Suturing the pillars is also recommended for severe hæmorrhage.

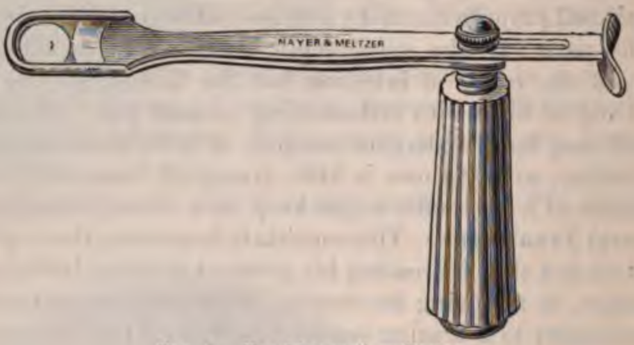

FIG. 2.—Heath's tonsil guillotine.

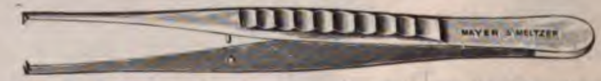

FIG. 3.—Toothed dissecting forceps for separating the pillars.

Enucleation.—This is specially indicated in embedded tonsils, often found in children where the pars palatina forms the greater part of the tonsil. It is also necessary in the small septic tonsil of adult life, which it may be impossible to remove with the guillotine, but which is often the seat of repeated quinsies. Enucleation and consequent removal of the capsule prevents there being any longer any peri-tonsillar space, and hence no peri-tonsillar

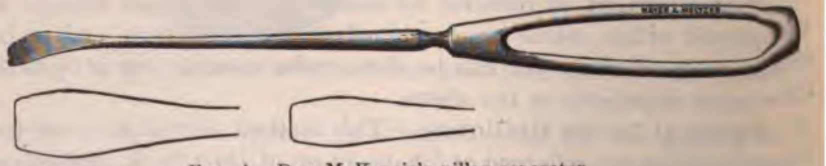

FIG. 4.—Dan McKenzie's pillar separator.

abscess can form. This result cannot be obtained by either cautery or punch forceps. The operation is also indicated in cases of cervical adenitis, where even a small portion of tonsil, if left, may continue to act as a source of infection.

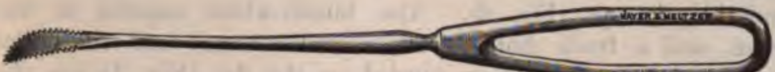

FIG. 5.—Emile Mayer's tonsil enucleator; the blade is serrated for tearing down adhesions.

In children the tonsil shells out easily, but in adults, where there are many adhesions as a result of old inflammation, and in cases where the pillars are adherent owing to the previous use of the guillotine, the operation is more difficult.

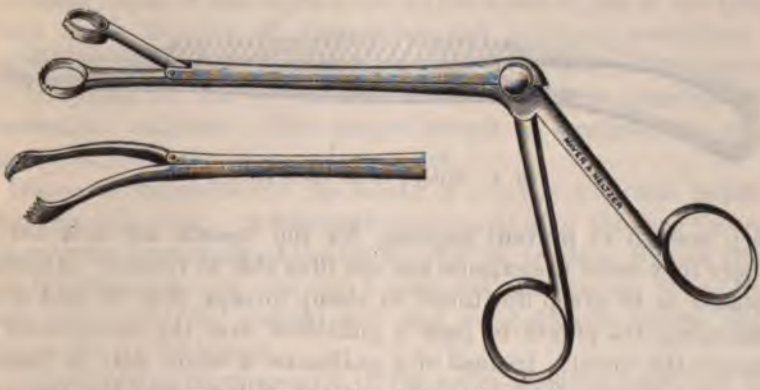

FIG. 6.—Forceps for grasping the tonsils.

The Operation.—Chloroform is the best anæsthetic, and the patient lies on the back with shoulders slightly raised. A suture is passed through the tongue and held by an assistant, who has a supply of gauze mops to mop the throat with. The reflection of mucous membrane from the anterior pillar is then divided from

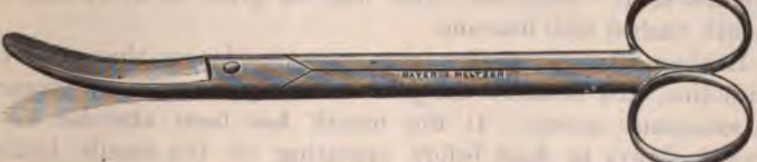

FIG. 7.—Long scissors curved on the flat for enucleation.

the base of the tongue up to the uvula. This is effected by small toothed dissecting forceps (Fig. 3) or by means of the pillar separator (Fig. 4 and 5). The tonsil is meanwhile grasped by suitable forceps (Fig. 6). The bluish-white capsule is then seen, and a fresh hold is taken of the tonsil and the pillars separated. Long scissors curved on the flat (Fig. 7) are then used for blunt dissection to free the tonsil from the superior constrictor which is attached to the lower part of the capsule, and are also used to strip up the lymphoid tissue which continues to the side of the tongue from the palatine tonsil. The tonsil is then completely removed.

There is very little hæmorrhage if the anæsthesia is level and deep enough to prevent gagging, for the vessels are torn across where they enter the capsule and are thus able to retract. Another method is to grasp the tonsil in clamp forceps (Fig. 8), and after separating the pillars to pass a guillotine over the forceps and so remove the tonsil. Instead of a guillotine a snare may be passed over the tonsil after separation of the pillars, and the removal completed by its means. Enucleation can be effected under local anæsthesia, but if it is done by dissection a general anæsthetic is more usually employed.

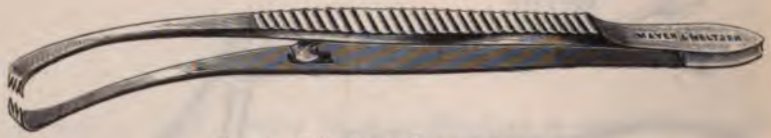

FIG. 8.—Tilley's tonsil catch forceps.

After-treatment.—The patient should be placed on his side, so that any blood may run out of the mouth. Fluid nourishment should be given at first, and chicken broth is preferable to milk for the first meal. Sterilised water may be given to drink and the mouth washed with listerine.

Healing after enucleation takes somewhat longer than after the guillotine, and in adults the pain for twenty-four hours afterwards is sometimes severe. If the mouth has been attended to, as should always be done before operating on the tonsils, healing as a rule will be uninterrupted.

G. SECCOMBE HETT.

RETAINED SECRETION WITHIN THE TONSILS.

SMALL white **plugs** consisting of epithelial *débris* and bacteria are often found in the supra-tonsillar fossa and crypts of the tonsil. They cause feelings of discomfort and pricking sensations in the throat. The crypts may be cleared by means of a stream of air projected on the tonsil, from a bulb and tube attached to a Eustachian catheter. This simple means of treatment is easily employed, and affords immediate relief.

Owing to obstruction to the mouth of a crypt a chronic tonsillar **abscess** may form. A yellowish swelling is seen showing through the mucous membrane of the tonsil, and on incision a thick curdy pus is evacuated. In one case I obtained one drachm of pus from each tonsil, and the patient had had no symptoms except slight discomfort in the tonsils.

Tonsilloliths occur usually in the supra-tonsillar fossa, but may also occur in the crypts. They consist of a nucleus of bacteria or leptothrix surrounded by phosphates or carbonate of lime and magnesia. They may be small, or large and weigh as much as 1 oz., and they may be hard or soft. Treatment consists in removal by scoop or forceps, preceded, if necessary, by incision over them.

G. SECCOMBE HETT.

SYPHILIS OF THE TONSIL.

In primary chancre of the tonsil boro-glyceride may be employed locally, and orthoform if dysphagia is marked. In secondary affections, the tonsils may be painted with Mandl's paint. If ulceration is present, a solution of chromic acid (gr. 10, ad ℥j) painted on the ulcer after drying is recommended, and should be repeated twice a day as long as necessary. For gumma of the tonsil, when ulceration is present, the throat should be sprayed with a warm alkaline solution, such as: ℞. Sodii Bicarbonatis, gr. 5; Boracis, gr. 5; Listerine, ʒj; Aquam, ad ℥ij. This will cleanse the ulcer, and later the following may be applied: ℞. Cupri Sulphatis, gr. 15; Glycerini, ʒij; Aquam, ad ℥j.

The general treatment appropriate to the stage of the disease should be employed. It must be borne in mind that the patient should be got rapidly under the influence of mercury in the early stages, and that mercury and potassium iodide should always be used in conjunction in all stages of syphilis of the tonsil and upper respiratory tract.

G. SECCOMBE HETT.

TUBERCULOSIS OF THE TONSIL.

There are three varieties of tuberculosis of the tonsil:—(1) Unhealthy tonsils with caseous plugs in crypts; (2) Chronic tuberculous ulcer of the tonsil; (3) Acute tuberculous ulcer as a terminal infection.

Children with **tuberculous adenitis** frequently have unhealthy, ragged tonsils, with lacunæ filled with caseous plugs, and in such cases tubercle bacilli can sometimes be demonstrated. The tonsils should be completely removed, and adenoids also if present, as this may save an operation on the glands. Such cases demonstrate the necessity for removing unhealthy tonsils in children, whether they be enlarged or not, and efficient treatment on these lines has of recent years diminished the number of cases requiring removal of the cervical glands.

Chronic tuberculous ulcer of the tonsil is a rare condition found in persons with chronic pulmonary tuberculosis, and is uni-lateral or bi-lateral. Palliative treatment consists in applying orthoform to the surface of the ulcer. If the patient's chest condition is not too far advanced, the ulcer should be curetted with a sharp spoon and 60 per cent. lactic acid rubbed in.

Acute tuberculous ulceration occurs as a terminal infection in advanced cases of pulmonary tuberculosis, often associated with miliary tubercles on the palate. Palliative measures only are indicated in such cases: orthoform and anæsthesine powder should be applied, and the parts painted with 10 per cent. cocaine if pain and dysphagia are extreme.

Lupus occurs on the tonsils, and is generally associated with a similar condition on the pharynx, fauces or palate. Curetting and the administration of tuberculin are indicated.

G. SECCOMBE HETT.

TUMOURS OF THE TONSIL.

Benign Tumours.—Simple fibromatous tumours grow from the surface of the tonsil. They are usually pedunculated, but may be sessile. Papillomata also occur, and frequently grow from between the pillars of the fauces near the base of the uvula. These latter are dealt with under Papillomata of the Uvula. The treatment of benign growths of the tonsil consists in removal, by cutting through the base or the attachment of the pedicle with scissors.

An unusually developed styloid process may push aside the tonsil or appear through it as a prominence. It is sometimes inadvertently removed with the guillotine, and thought to be a cartilaginous or bony tumour of the tonsil. As a rule it does not require treatment; but if very prominent, and causing symptoms, the tonsil should be dissected off it, and the prominence removed with bone forceps. Deposits of cartilage and bone are occasionally found in the tonsils, they are analogous to those sometimes seen in the parotid and testis.

Malignant Tumours.—*Carcinomata* of the tonsil occur at or after middle life. They are characterised by a hard, fixed, ulcerated mass, which soon spreads beyond the confines of the tonsil.

Treatment consists in operation when the disease is not too far advanced. The primary growth should be removed, and a dissection of the cervical glands carried out. An extensive external operation is necessary. The jaw should be severed, and besides the growth, the pillars of the fauces, together with a portion of the soft palate, pharyngeal wall and tongue, have usually to be included.

Sarcomata of the tonsil occur at all ages. Small children, young adults, and persons of middle age and after may be affected. They occur as encapsuled enlargements of the tonsil, starting on one side and frequently involving the other.

Treatment consists of early and complete removal of primary and secondary growths. An intra-buccal operation on the lines of an extended enucleation often gives the best results. The peri-capsular space is entered by an incision external to the anterior pillar and the tonsillar growth shelled out. The pillars of the fauces and the lymphoid tissue at the base of the tongue are removed in one piece with the growth, and the other tonsil should be enucleated at the same time. The tongue should be drawn forward by a suture through it, the mouth widely gagged open, and good illumination by means of head-light employed. The cheek on the opposite side may be split in order to obtain more room and a better view, but in my experience this has generally been unnecessary. A preliminary laryngotomy in adults and tracheotomy in children is advisable, and the pharynx can then be plugged, but this is not always essential.

If the tumour has spread extensively on to the tongue, an external operation similar to that for carcinoma should be done. When a malignant growth of the tonsil is inoperable, palliative treatment must be employed. In cases of carcinoma the ulcer becomes very septic and dysphagia is then marked. Local applications of orthoform and anæsthesine or cocaine are indicated in order to relieve pain and allow nourishment to be taken.

In sarcomata it may be necessary to remove the primary growth for the relief of obstruction even when the glands are inoperable, or tracheotomy may be necessary in order to prevent asphyxia.

Liquor arsenicalis often causes a marked diminution of primary and secondary growth, but its effect is as a rule temporary. Coley's fluid has been used with some success, but the reaction is often severe.

G. SECCOMBE HETT.

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DISEASES AND AFFECTIONS OF THE LINGUAL TONSIL.

The lingual tonsil consists of an irregular, bi-lateral mass of lymphoid tissue situated at the base of the tongue, in front of the epiglottis and behind the papillæ. It is a portion of Waldeyer's ring, and is often continuous laterally with the lower part of the palatine tonsils. It is frequently well marked in adult life, and in persons in whom the palatine tonsils have atrophied. It is subject to all the diseases which affect the pharyngeal and palatine tonsils, but with much less frequency.

Method of Examination.—The lingual tonsil can often be seen, especially when it is enlarged, by direct examination, if the tongue is depressed by a tongue depressor and a reflected light employed. A complete view can always be obtained by the use of the laryngeal mirror, and this method should always be employed in cases of suspected disease. The result of inspection by means of the mirror should be confirmed by direct palpation where there is any suspicion of malignant disease. The tongue is grasped in a tongue cloth and drawn forward by the left hand, while the right forefinger is used for palpation.

Acute Lingual Tonsillitis.—This frequently occurs as an accompaniment of acute palatine tonsillitis and does not then, as a rule, cause any special symptoms, and the treatment employed should be the ordinary treatment for acute tonsillitis.

Acute lingual tonsillitis may occur in persons of middle age where the palatine tonsils have atrophied or are not involved.

Symptoms.—Difficulty of articulation, with difficulty of protrusion of the tongue and dysphagia, are the typical symptoms of acute lingual tonsillitis. If an abscess of the lingual tonsil occurs, these symptoms are well marked, while, in addition, a one-sided dysphagia is very typical of lingual quinsy. Acute inflammation of this structure has caused œdema of the larynx.

The sublingual glands may be enlarged in acute lingual tonsillitis but the infiltration of the floor of the mouth met with in Ludwig's angina is absent.

Treatment.—The same treatment as for acute palatine tonsillitis (p. 747) should be adopted. A watch should be kept on the respiration and on the local condition to see that the epiglottis does not become œdematous from extension of the inflammation. Œdema of the larynx may occur and necessitate tracheotomy, but this is rare if efficient treatment is carried out.

A lingual quinsy should be incised as soon as it is diagnosed. The lingual tonsil is first painted with 10 per cent. cocaine, and then incised with a pointed bistoury on a curved handle, guided by the finger or by inspection with the laryngeal mirror. Heryng's handle with knife-blade attachment is useful for this purpose.

Chronic Lingual Tonsillitis.—The lingual tonsil may become hypertrophied, but, as a rule, gives rise to no symptoms. It is frequently enlarged in children as an accompaniment of chronic enlargement of the palatine tonsile. Hypertrophy of the lingual tonsil is not uncommon in middle life, and often so without any attendant pathological condition of the palatine tonsil.

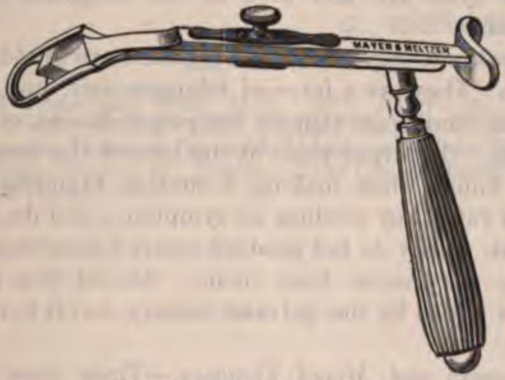

FIG. 1.—Lingual tonsillotome.

Symptoms.—Symptoms when present are those of cough, sensation of a foreign body in the throat, irritation and discomfort. Most of the patients in whom the condition is associated with marked symptoms are neurotic, and the *rôle* of the hypertrophy in producing symptoms has been much exaggerated.

Treatment.—Attention to the general health, with treatment of indigestion and constipation if present, is indicated. Limitation of alcohol and tobacco should be enjoined. Carious teeth and pyorrhœa should be treated. If this does not effect a cure of the symptoms, an alkaline spray or mouth-wash should be used, together with Mandl's paint and a krameria lozenge. If more radical treatment is required, owing to continuance of the symptoms or recurrent attacks of lingual tonsillitis, operative measures should be adopted. These consist in diminution of the mass by means of successive punctures with the galvano-cautery, or removal.

Removal of the lingual tonsil may be effected after cocainisation by means of the lingual tonsillotome (*see* Fig. 1), or by punch-forceps. Punch-forceps similar to those used for removal of the epiglottis are useful for this purpose. Where the palatine tonsils have to be removed, the lingual prolongation and lingual tonsil can often be dissected out in one piece: this is especially the case in children. When effecting this, care must be taken not to strip up the mucous membrane of the tongue.

Chronic Abscess of the Lingual Tonsil.—This has occurred, but is very rare.

Benign Tumours.—(1) *Cysts.*—An occlusion cyst occasionally occurs as a result of the blockage of the duct of a mucous gland Thyro-lingual cysts are met with in the neighbourhood of the foramen cæcum.

(2) *Angiomata.*—Congenital blood tumours are found at the base of the tongue. They are a form of telangiectasis, and are usually associated with similar growths on the palate, fauces, or other parts of the tongue. Enlarged veins at the base of the tongue are not infrequently found when making a routine examination of this region. As a rule, they produce no symptoms, and do not require any treatment. They do not produce severe hæmorrhage, although slight oozing may occur from them. Should this happen, the vessel may be sealed by the galvano-cautery, but it is rarely called for.

(3) *Papillomata and Mixed Tumours.*—These have occurred in this situation, but are rare.

(4) *Pharyngo-keratosis*—This is a favourite situation. The growths are usually associated with a similar condition in the pharynx, fauces, or palatine tonsil (*see* section on Diseases of the Palatine Tonsils, pp. 747 *et seq.*).

Malignant Tumours.—Carcinoma of the lingual tonsil usually starts at middle age or after, and is commoner in men than women. Chronic irritation from excess of alcohol or tobacco or syphilis have been regarded as predisposing causes. The growth commences as a small nodule or ulcer on one side of the middle line. The superficial appearance of the growth is often insignificant, and may be very easily missed unless a routine examination is made. It tends to infiltrate deeply into the muscles at the base of the tongue rather than to proliferate on the surface. The first symptom may be a limitation of protrusion of one side of the tongue. If there is ulceration, dysphagia will be complained of. There is discomfort in the throat and a sensation of a foreign body if there is much enlargement of the lingual tonsil.

Treatment.—An early diagnosis is most important if treatment is to be of any avail, and a laryngoscopic examination should be made, aided by direct palpation with the finger. Removal of a large portion of the tongue is usually necessary, together with clearance of the cervical glands. If the case is beyond operative interference, direct application of radium to the growth should be employed. Applications of cocaine, orthoform, or anæsthesine may be necessary for the relief of dysphagia. (*See* palliative treatment in article on Malignant Disease of the Palatine Tonsil, p. 758.)

The growth, if unchecked, tends to spread on the lateral pharyngeal wall, and also to involve the epiglottis and larynx. In the latter case, it may be necessary to do tracheotomy to avoid asphyxia.

G. SECCOMBE HETT.

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RHEUMATIC AFFECTIONS OF THE THROAT.

CERTAIN affections of the throat are regarded as being sometimes associated with rheumatism. In the naso-pharynx lacunar inflammation of the pharyngeal tonsil is occasionally dependent on the rheumatic poison. Naso-pharyngeal catarrh may occur as part of a general pharyngitis, which is a common complication of acute rheumatism, and it may appear a few days before the articular pains. Lacunar tonsillitis is not infrequently met with in rheumatism, some writers believing that the tonsils are the portals of infection. The association of other affections is not so clear. A rheumatic laryngitis has been described in which local pain has been marked and the larynx appeared injected and at points œdematous. Inflammation of the crico-arytenoid joint leading to the fixation of the vocal cord has been ascribed to rheumatism. As a rule, the relation is based on the co-existence of other rheumatic manifestations and on the effect of treatment. Accordingly, when it is suspected, the salicylates should be administered in full doses and warm alkaline washes and sprays may be used locally. Rest to the voice should be enjoined and the patient restricted to liquid food. After the acute stage has passed off, brushing the naso-pharynx with a solution of chloride of zinc (10 to 15 gr. to the ounce), once or twice a week, is very helpful. When recurrent attacks of tonsillitis are followed by articular manifestations treatment of the tonsil should be undertaken. *Morcellement* with the tonsil punch, by which all the affected crypts are opened up, is usually sufficient or the tonsil may be completely excised. The pharyngeal tonsil may be removed with the post-nasal curette.

D. R. PATERSON.

DISEASES AND AFFECTIONS OF THE PHARYNX.

ACTINOMYCOSIS.

ACTINOMYCOSIS is rarely found in the upper air passages. It begins almost always in the mouth cavity and is due to an invasion of the tissues by actinomyces. Its starting point is generally in the alveolar process of the lower jaw around carious teeth, and it spreads backwards into the pharynx, the tongue and the cheek. Very rarely it affects the tonsils. In the lower jaw it forms larger or smaller tumours which may eventually suppurate and discharge or leave a fistula. The treatment is chiefly surgical and consists in widely laying bare the diseased tissue, and in the extraction of teeth, the alveoli of which are affected. It is not, as a rule, necessary to operate extensively, as exposing the affected area and packing with iodoform gauze is often sufficient to destroy the organism, which is anærobic. When the infiltrated tissue is very hard and the incision does not give exit to pus, injections into the parts of perchloride of mercury (¼ per cent.) are of value. Iodide of potassium, both locally and internally, has been much used. Large doses (15 to 45 gr. daily) are necessary, as well as local injections of a 5 per cent. solution. Perhaps the best form of treatment is to combine internal administration of the iodide with surgical measures.

D. R. PATERSON.

CATARRHAL PHARYNGITIS.

ACUTE CATARRHAL PHARYNGITIS.

Acute pharyngitis may manifest itself as: (1) Part of an inflammatory attack involving more or less of the upper respiratory tract, as in the course of a cold or certain of the exanthemata; (2) diffuse inflammation of the posterior wall of the pharynx, which is uncommon and probably of an erysipelatous nature; and (3) localised inflammation affecting the uvula or granulations on the posterior or lateral wall of the pharynx.

In severe cases, children, elderly persons and those subject to bronchitis, it is advisable to keep the patient indoors, and if fevered, in bed. The diet should be light, and calomel followed by a saline aperient should be given.

At the onset or during the early stage of an attack abortive treatment may be tried. If ushered in with a chill and symptoms of general malaise, diaphoresis should be aimed at by means of a hot foot-bath, warm drink, and Dover's powder. With the same object quinine and salol (45 to 60 gr. daily), have been recommended.

If rheumatism is suspected, salicylates should be at once administered; guaiacum lozenges in the writer's experience have proved disappointing. Pain in the muscles of the neck may be soothed by the application of an ointment containing methyl-salicylate and menthol. When the pharyngitis is of a gouty nature, aspirin, colchicum and alkalies are indicated. Dr. Watson Williams recommends the following: ℞. Tinct. Colchici Sem., ♏20; Sod. Salicyl., gr. 20; Tinct. Digital., ♏3; Aq. ad ℥½, M. Sig. [U.S.P. ℞. Tinct. Colchici. Sem., ♏40; Sod. Salicyl., gr. 20; Tinct. Digital., ♏3; Aq. ad ℥½]. To be taken in a tumblerful of Vichy water (Celestin) twice or thrice daily.

If local symptoms predominate, with little or no constitutional disturbance and the patient is not confined to the house, local measures should receive chief attention. Painting the pharynx with a solution of silver nitrate (gr. 10 to 30 ad ℥j) has been highly recommended for aborting an attack. The following solution has the same effect, and after the inflammation is established serves as a sedative; it may be used as a paint or spray for both pharynx and nose: ℞. Camphor., gr. 10; Menthol., gr. 40; Paraffin. Moll. Liq., ℥j. M. [U.S.P. ℞. Camphor., gr. 10; Menthol., gr. 40; Petrolati Liq., ℥j].

The subsidence of œdema of the uvula may be hastened by scarification. Extension to the larynx, trachea and lower respiratory tract should be met by the inhalation of steam impregnated with compound tincture of benzoin (ʒj ad Oj) during the earlier stages, and later when the secretion has become tough and adherent, with the following: ℞. Creosot., ♏80; Magnes. Carb. Lev., gr. 40; Aq. ℥j, M. Sig. A teaspoonful in a pint of water at 140° F. for each inhalation.

For severe pain, chips of ice are preferred by some, while warm drinks afford most relief to others. Pastilles or lozenges containing cocaine, menthol or antipyrin assist in alleviating the pain. Pyramidon, phenacetin and aconite reduce both pain and temperature. Heroin and codeine lessen the cough.

CHRONIC CATARRHAL PHARYNGITIS.

Chronic pharyngitis is usually described as occurring in one of three forms: 1. Hypertrophic pharyngitis, which includes granular pharyngitis and hypertrophy of the lateral wall of the pharnyx. 2. Atrophic pharyngitis, or pharyngitis sicca. 3. Simple catarrhal pharyngitis, with which will be considered pharyngeal irritation.

Granular pharyngitis is a very common condition but only exceptionally causes symptoms. If there is reason to attribute the rawness in the throat to large prominent granulations, or irritation passing up towards the ear to a thickening or group of granulations on the lateral wall of the pharynx, these should be destroyed. This is best effected by the galvano-cautery point, each granulation being burned down to the level of the surrounding mucous membrane. If the necessary outfit is not available, silver nitrate fused on the point of a probe may be rubbed into the granulations; the action will be assisted by making a small incision into the granulations beforehand. Chromic acid may be used similarly, but the patient must be careful not to swallow any of the solution, or vomiting and other symptoms of irritant poisoning may be excited. When the granulations are exceptionally large they may be removed quickly and satisfactorily by means of punch forceps (*e.g.*, Grünwald's cutting nasal forceps).

Atrophic or dry pharyngitis is nearly always associated with atrophic rhinitis, or abnormal width of the nasal fossæ. The dryness in the throat complained of may be due to an actual deficiency in the amount of secretion poured out, owing to a greater or less destruction of the glands as a result of the atrophic process; or there may be no atrophy in the pharynx, but the inspired air in passing through the unduly wide nasal cavities may be insufficiently warmed and moistened so that on reaching the pharynx it continues to abstract heat and moisture and thus produces dryness of the mucous membrane.

The treatment should therefore aim at securing as high as possible a state of efficiency of the respiratory functions of the nose. The crusted secretion usually found in atrophic rhinitis should be loosened and removed by douching the nose once or twice daily with a warm solution of bicarbonate of soda (℥j ad Oj). The glandular action may be stimulated by the addition of salt to the douche, and by occasionally painting the nasal mucous membrane with iodine solution (*vide infra*).

If after these measures have been used in the nose, dryness is still experienced in the throat, similar treatment should be employed in the latter region. The dried secretion lining the posterior pharyngeal wall should be sprayed or brushed off with soda bicarbonate solution. To prevent the clean mucous membrane from quickly drying again it should afterwards be sprayed with liquid vaselin, to which oil of sandalwood and oil of cinnamon (āā ♏5 ad ℥j) may be added. To increase the secretory activity, the pharynx should be thoroughly painted with an iodine solution, *e.g.*, Mandl's solution No. 1 or 2 (℞. Iodine, gr. 6 or 12; Potassium Iodide, gr. 25 or 50; Oil of Peppermint, ♏5; Glycerine, ℥j). For the same purpose rectified spirit or petrol with a few drops of oil of eucalyptus has been recommended.

In the writer's experience the majority of patients complaining of pharyngeal symptoms, *e.g.*, rawness, irritation or heat in the throat, discomfort after using the voice, susceptibility to cold in the throat, etc., have no visible abnormal condition in the pharynx to which the symptoms can be attributed. It is convenient, however, to consider these cases of what may be termed pharyngeal irritation with simple catarrhal pharyngitis, for the two conditions cannot always be differentiated, and many of the causes are common to both. In pharyngeal irritation the sensations experienced in the pharynx are in reality symptomatic of disturbance elsewhere; in simple catarrhal pharyngitis local changes are evident to which the symptoms can be attributed.

The important point to keep in view is that the treatment of many troublesome pharyngeal symptoms and of the slighter manifestations of chronic pharyngitis does not consist in the use of paints, sprays, gargles, or other local therapeutic measures; indeed in the majority of cases nothing need be done to the pharynx itself. A successful result is to be expected only after the disturbing cause has been discovered and removed; this is often a difficult problem and requires the exercise of careful judgment for its correct solution.

If an obviously diseased condition is present in the pharynx or its neighbourhood, which is capable of giving rise to the symptoms complained of, it should receive consideration. Thus, an elongated uvula may excite a tickling sensation or cough, and may predispose to acute attacks; under these circumstances it should be shortened. This is accomplished by painting it with cocaine solution, grasping the tip with forceps and drawing it downwards and forwards, and snipping off sufficient. Special uvulotomes have been introduced for the operation, but it can be satisfactorily performed with a pair of scissors, preferably blunted at the points so as to avoid injury to the posterior wall. The cut should be made obliquely so that the raw surface is directed backwards. Considerable pain is experienced afterwards. Uvulotomy was at one time greatly in vogue, but in reality is seldom called for.

Tonsils that are enlarged or the seat of chronic lacunar inflammation, and adenoids, if found the starting-point of attacks, should be removed. Attention to the teeth is also advisable.

Gastric derangements causing pyrosis and flatulence in some persons produce a feeling of heat or fulness in the throat with inclination to swallow frequently. Congestion of the liver and constipation may aggravate pharyngeal symptoms. Those with anæmia, uterine disorders, or at the climacterium, may complain of various disagreeable sensations; these, however, are more of the nature of paræsthesiæ.

Rheumatism and gout have been mentioned as important etiological factors in acute pharyngitis; they may also be the underlying cause of chronic pharyngitis, and should receive appropriate treatment. In the gouty, uric acid or lithæmic sore throat, the mucous membrane is irritable and local applications are apt to be harmful rather than otherwise.

The habits of the patient in regard to alcohol, tobacco, and very hot or highly spiced foods, also the atmospheric conditions to which he is exposed, especially if the voice is much used, should be enquired into, and if necessary corrected as far as possible.

The nasal cavities demand special consideration, for in them lies the cause of most cases of pharyngeal irritation. The subject cannot be fully discussed here, it must suffice to indicate briefly some of the conditions that may be at fault. As a rule, sufferers from pharyngeal irritation breathe entirely or almost entirely by the nose, but it will be found that one nasal fossa is wide while the other is narrow; the narrowing may be constant, as when due to a deviation of the septum, or it may be intermittent owing to the varying engorgement of the inferior turbinates. On the other hand, the nasal passages may be equal but too free, and the secretion may be too scanty. Lastly, the nose may be obstructed so that more or less buccal respiration is necessary. Under all of these conditions the inspiratory current is imperfectly warmed, moistened and filtered, and the pharynx suffers in consequence. For the relief of pharyngeal irritation in such cases, nasal treatment is of first importance.

A. BROWN KELLY.

ACUTE MEMBRANOUS ANGINA.

SEVERAL acute non-diphtheritic affections of the pharynx may be accompanied by the formation of a false membrane. These are differentiated according to the prevailing micro-organism, namely, streptococcus, staphylococcus, pneumococcus, bacterium coli, Friedländer's bacillus, Vincent's fusiform bacillus and spirillum, etc.

Streptococcus Angina is usually a serious illness. Anti-streptococcus serum should be tried; 10 cc. may be injected every twelve hours in severe cases. When the streptococcus is associated with the bacillus of diphtheria, injections of the two serums may be given. Local treatment by means of steam tent, antiseptic gargles, douches, paints, insufflations, etc., should be employed as in diphtheria.

Membranous angina due to Frieländder's bacillus may be exceedingly chronic. The writer has seen the condition persist for weeks, and the pharyngeal discomfort pass off only after the patient was sent to the country.

Vincent's Angina, or ulcero-membranous angina and stomatitis, is probably the commonest of the membranous anginas. Many of the cases are overlooked, being mistaken for diphtheria. A cure is effected in a few days by painting the ulceration twice daily with tincture of iodine. Chlorate of potash, if not too irritating, or hydrogen peroxide may be used as a mouth wash.

A. BROWN KELLY.

ACUTE SEPTIC INFLAMMATION OF THE PHARYNX AND LARYNX.

(Including Erysipelas, Phlegmon and Acute Inflammatory Œdema of the Pharynx and Larynx, and Phlegmon of the Cellular Tissues of the Neck (Angina Ludovici).)

The views advanced by Sir Felix Semon as to the pathological identity of the affections grouped in the sub-title have been generally accepted; their treatment may therefore be considered under one heading.

In dealing with acute septic inflammation of the pharynx and larynx the following facts should be kept in view: The disease may develop with great rapidity, and if the larynx is involved may cause dangerous dyspnœa within a few hours; it may run its entire course and terminate fatally in half a day; although at first mild it may become severe; and the local appearances may be so insignificant that the real gravity of the condition is not appreciated.

The patient is usually suffering great pain when first seen. For the relief of this, ice chips may be sucked, and cold may be applied to the neck by means of an ice-bag or Leiter's tubes. Semon has emphasised the importance of using these cold applications with caution owing to their lowering the vitality of the diseased tissues and favouring necrosis.

Other sedative medicaments are mentioned in the section on acute pharyngitis. Œdema of the epiglottis or arytenoids is sometimes relieved by scarification. With the first signs of dyspnœa preparations should be made for intubation or tracheotomy, and with increasing distress one or other procedure should be carried out before the symptoms become urgent. Purulent collections should be evacuated as soon as detected; early and free external incision is of the greatest importance in Angina Ludovici.

The strength should be maintained and heart failure guarded against. Internally, tincture of the perchloride of iron (♏ 30 t.i.d.) [U.S.P. tincture of ferric chloride (♏ 22 t.i.d.)] and quinine (gr. ¼ to 5 t.i.d.) should be administered; digitalis may be added if the pulse is feeble. Alcohol and strychnine are also useful. The frequent inhalation of oxygen is recommended by Semon if pneumonia develops.

In the severer cases the most important part of the treatment aims at checking the infection. For this purpose the nature of the invading micro-organism should be investigated and a corresponding antitoxin injected. If this is impracticable, knowing that the streptococcus pyogenes is the organism most frequently found in this disease, a polyvalent anti-streptococcus serum should be injected; 20 c.c. should be used at once and the dose repeated as required.

A. BROWN KELLY.

CHRONIC HYPERPLASIA OF THE MUCOUS MEMBRANE OF THE UPPER RESPIRATORY TRACT.

THIS is generally a sequence of repeated attacks of catarrh which have led to swelling and thickening of the mucous membrane and is accompanied by altered secretion. The whole upper tract is implicated, similar changes taking place in nose, pharynx and larynx. Hereditary predisposition plays a part, as it may be observed in more than one member of a family. Obstructive conditions in the nose favour it, probably by keeping up catarrhal change. It follows irritation from dust and over-indulgence in tobacco and alcohol, being met with in publicans. It occurs in voice users, clergymen, schoolmasters, etc., from over-use or wrong use of the voice and in people like costermongers, who shout much and are exposed to weather. Very often it is secondary to suppuration in the nose, from which pus runs into and infects the pharynx and larynx. Not infrequently it affects the subjects of chlorosis and general anæmia, and gout and rheumatism predispose to it. The patient hawks and scrapes the throat to expel the secretion and no doubt these efforts, especially when they are excessive, keep up the condition. In the matter of treatment, attention to the general health is in many cases of more importance than local treatment. Constitutional conditions should therefore be appropriately treated, anæmia by iron and arsenic, gout and rheumatism by their specific remedies. Habits ought to be carefully regulated and for many patients a course of alkaline or aperient waters at a spa is helpful. Locally, nasal conditions should be treated by surgical means if necessary. Alkaline washes and astringent solutions and, where there is much thickening of the mucosa, touching with the galvano-cautery are of service.

D. R. PATERSON.

GOUTY AFFECTIONS OF THE PHARYNX.

The pharynx is frequently the seat of gouty manifestations. Acute gouty pharyngitis, tonsillitis or laryngitis may occur in persons prone to gout. In the chronic form the soft palate fauces and posterior wall of the pharynx appear red and congested and the lateral walls of the pharynx thickened. The patient complains of pain and discomfort in swallowing and frequently of a feeling of dryness and irritation and a sensation of tickling. These affections are usually met with in persons with sluggish liver action and in whom there is a definite history of gout. Some writers confine the term to affections found in gouty subjects and which yield only to remedies for gout. Their treatment is that of systemic gout. Colchicum, in the form of the wine (ten to twenty drops), with 40 to 60 gr. of citrate of potassium, should be administered three times a day. For the relief of portal congestion blue pill (3 to 4 gr.) at night time, followed by a dose of Epsom salts in the morning, is very useful. In the more chronic form iodide of potassium (5 to 10 gr.) three times a day, is very helpful. Diet and regimen are of great importance. Tobacco and alcohol should be restricted and highly spiced foods avoided. As most of these patients take too little exercise, a moderate amount should be enjoined. Locally alkaline washes and sprays and brushing with a solution of menthol are of service. In the naso-pharynx an application of chloride of zinc or nitrate of silver (10 to 20 gr. to the ounce), by means of a short-curved cotton-wool carrier, once or twice a week, gives great relief. Touching granules and the thickened lateral wall of the pharynx with the cautery is of advantage. A stay at a suitable watering-place, where regular habits of life with regular and sufficient exercise are carried out, expedites the cure.

D. R. PATERSON.

PHARYNGEAL HÆMORRHAGE.

A TRUE pharyngeal hæmorrhage may be symptomatic of disease of the blood or blood-vessels, or of abnormal blood pressure, *e.g.*, leukæmia, purpura, hepatic, renal and cardiac affections. Under these circumstances the treatment of the underlying disease is of first importance.

It may also follow operation, or the erosion of a large vessel by suppuration or ulceration, when it may be necessary to employ direct pressure with a swab on the finger or forceps, or by means of one of the various instruments (*e.g.*, Broca's) designed to compress the persistently bleeding stump of a tonsil; in these a pad is applied directly and another exercises counter-pressure over the corresponding part of the neck. When the hæmorrhage is from the tonsillar region it can sometimes be controlled by stitching together the anterior and posterior faucial pillars. If these measures fail, ligature of the common carotid will be called for.

In the majority of patients who complain of "bleeding from the throat" the blood is not of pharyngeal origin. The site may be in the nose or naso-pharynx. Thus, the blood mixed with saliva which stains a child's pillow in the morning usually comes from adenoids; and the tinge of blood in the morning expectoration of older subjects originates commonly from sponginess of the gums or crusting in the naso-pharynx. Larger quantities of blood suddenly hawked or coughed up are usually of pulmonary origin.

In the last group of cases the examination of the lungs is often negative, and it is then suggested that the blood comes from a vessel in the pharynx. I have never observed an idiopathic pharyngeal hæmorrhage, although this is said to take place occasionally from enlarged veins on the posterior wall of the pharynx and at the base of the tongue. In the absence of any discoverable source in the upper air tract, such cases, in my opinion, should be treated as if the hæmorrhage were pulmonary, until the various methods of diagnosing tuberculosis have been employed with negative result.

If the bleeding can be traced to a varix or prominent vessel in the pharynx it can be checked with the galvano-cautery point. In the rare affection of multiple telangiectases the writer has found ctrolysis with the positive needle in the telangiectasis preferable the galvano-cautery.

n moderate and slight pharyngeal hæmorrhage one or more of following agents may be employed with the object of checking eding: Ice chips in the mouth, ice-bag to the neck, hot foot-h, swabs saturated with hydrogen peroxide, perchloride of iron adrenalin, freshly made paste of gallic acid (1 part) and tannic d (3 parts) (Hovell), and calcium salts internally.

A. BROWN KELLY.

HERPES OF THE PHARYNX.

The term "Herpes" as applied to the mouth and pharynx includes three affections, namely, herpetic angina, herpes zoster or zona, and chronic recurring herpes.

Herpetic angina or herpes of the pharynx sets in abruptly with constitutional disturbance and follows an acute course lasting from four to six days. Treatment similar to that of an ordinary acute angina should be adopted, namely, a purgative, and tincture of perchloride of iron and chlorate of potash. The pain may call for pyramidon or antipyrin internally, and ice, cocaine pastilles, etc., locally. Moure recommends as an antiseptic paint: ℞. Solution of Carbolate of Soda, ♏12; Resorcin, gr. 6; Glycerine, ℥j. M. Sig. To be applied to throat once daily. If there is a tendency to recurrence, arsenic should be given.

Bucco-pharyngeal zona is accompanied by slight, if any, general symptoms, and runs a sub-acute course lasting from two to three weeks. At the onset there is sharp burning pain which gradually diminishes after the eruption of a group of vesicles. The distribution of the latter follows the course of a branch of a sensory nerve, usually the infraorbital division of the fifth, and, with rare exceptions, is unilateral. This variety does not recur. The neuralgic pains may be relieved by paints or gargles containing menthol, and aspirin or pyramidon internally. Any underlying disturbance, especially of the nervous system, should receive suitable treatment.

Chronic recurring herpes is found chiefly in debilitated subjects and may persist for years. Only one or a few vesicles form at a time, causing discomfort rather than pain. Arsenic should always be tried; in some patients it effects a cure, but in others it fails to benefit. Hutchinson recommends that at least 3 min. of Pearson's solution be given daily and continued if necessary for six or twelve months. Chlorate of potash solution, one of the most valuable mouth washes, is said to aggravate the condition. All irritation is to be avoided, and a simple gargle prescribed, *e.g.*, borax and tincture of rhatany, or weak permanganate of potash.

Small herpetic ulcers bear a superficial resemblance to mucous patches and are the more liable to be mistaken for these, as many of the subjects of herpes have had syphilis. Specific remedies, however, should not be used in these cases, even if a history of syphilis is obtainable, for they appear to have no influence on the herpes; most benefit is to be expected from arsenic.

A. BROWN KELLY.

KERATOSIS OF THE PHARYNX.

In pharyngo-keratosis whitish yellow excrescences or plaques appear, mostly on the faucial tonsils and base of tongue, occasionally on the posterior and lateral walls of the pharynx, rarely on the epiglottis and larynx. These points often have an elongated horn-like appearance, due to the epithelium of the tonsillar crypts becoming cornified. This affords a lodgment for the leptothrix buccalis, the common saprophyte of the mouth—the connection with which seems to be incidental rather than causal. It is a very obstinate affection, causing few or no symptoms, beyond slight dryness and occasional cough. It is extremely difficult to get rid of, as it recurs whatever is done. As it tends to get well of itself after a time, many authorities advise leaving it alone. It produces very little discomfort except to nervous patients who are worried by "something white" in the throat. Picking off the points with a fine forceps and rubbing into the part chloride of zinc (40 gr. to the ounce), trichlor-acetic acid on a probe, or strong iodoglycerine at intervals of two or three days, is occasionally of use. Touching the points with the galvano-cautery has been tried with varying success, as has a 25 per cent. solution of salicylic acid in spirit. Exposure to the X-rays has been advocated. If the tonsils are large and much affected, *morcellement* or removal of parts of it by punching, followed by the galvano-cautery, will give some relief. But whatever is done, many of these cases recur, so that some authorities content themselves by prescribing a good tonic and sending the patient for a change of air.

D. R. PATERSON.

LEPROSY OF THE NOSE, PHARYNX AND LARYNX.

THE disease affects the mucosa of the upper respiratory tract, attacking the nares first and spreading thence to the palate and fauces, and, finally, to the larynx. The nodular form is the variety found in these regions; the anæsthetic type is very rare, and is said only to occur after the cutaneous manifestations have existed for several years. The affection is characterised by a hard nodular infiltration, which slowly ulcerates; local healing occurs, accompanied by the formation of much dense cicatricial tissue. There is no pain, the symptoms in the nose are those of obstruction, followed, in the stage of ulceration, by extremely foul watery discharge. In the larynx the disease causes hoarseness and aphonia, and later gradually increasing dyspnœa; eventually the cartilages may be involved by ulceration and necrosis occur.

General Treatment.—The most reliable therapeutic measure is the administration of oleum gynocardiæ, or chaulmoogra oil in capsules or in milk in daily doses rising from 30 to 450 minims; the best effect is obtained with the larger doses. This should be combined with inunctions twice a day of the same oil, either pure or diluted with an equal quantity of lime-water. Gurjun oil is used internally and externally in the same way, but appears to be less generally efficacious. Many attempts have been made with serum therapy[1]; but this treatment, though hopeful, is still in the experimental stage. "Nastin," a neutral fat extracted from cultures of a streptothrix obtained from leprosy nodules, was introduced by Deycke; it is administered subcutaneously, but was found to be inert in cases where it was tried by Dr. Ashburton Thompson,[2] the head of the Public Health Department of New South Wales.

Local Treatment consists chiefly in the application of antiseptics in the ulcerative stage. A 10 per cent. aqueous solution of resorcin is a useful pigment for the purpose, and De la Sota has had good results from the application of 10 per cent. chloride of zinc. Leprous tissues are very tolerant of surgical interference and heal rapidly; the cautery or knife may occasionally be usefully employed to remove obstructive nodules, and there should be no hesitation in performing tracheotomy when dyspnœa threatens.

HAROLD BARWELL.

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[2] Brit. Med. Journ., 1910, I., p. 565.

LUPUS OF THE PHARYNX.

The lesions are seen principally on the edges of the soft palate and on the uvula, appearing to have spread downwards from the nose and nasopharynx, and only slowly extend to the pharyngeal wall and pillars of the fauces. Symptoms are practically absent, so that the disease in this region readily escapes attention.

General constitutional treatment is of great value, and consists in an open-air *régime*, plentiful food, cod-liver oil, and, above all, arsenic in full doses. The administration of tuberculin is of value in some cases, but should not be given in doses large enough to excite any marked local reaction (*see* Tuberculin Therapy, p. 291). Under such treatment the disease frequently clears up to a certain extent and leaves less to be done by local measures than would at first appear necessary. It is, therefore, wise, at any rate in the slighter cases, to abstain from local treatment at first, while the condition is improving under constitutional measures. The remaining nodules should be then thoroughly and perseveringly destroyed by galvano-cautery puncture under local anæsthesia, while ulcers should be curetted and subsequently treated with frictions of lactic acid from half to full pharmacopœial strength. Recurrences are frequent, and the patient must be seen at intervals of three months until completely free for at least a year. The nares are often also involved, and indeed are probably the usual site of the primary invasion, and must be carefully examined with a view to eradicating the disease from the body (*see* Lupus of Nares and of Larynx).

HAROLD BARWELL.

NEUROSES OF THE PHARYNX.

Nervous affections of the pharynx may be divided into neuroses of sensation and neuroses of motion.

NEUROSES OF SENSATION.

Anæsthesia of the pharynx may be met with in nervous disorders, such as bulbar paralysis, diphtheritic paralysis and hysteria.

Hyperæsthesia is most commonly seen in nervous and hysterical people, and in men the subject of chronic alcoholism, but may be found in individuals who are apparently otherwise healthy. It adds greatly to the difficulty of the examination of the parts and especially of the larynx. The sensitiveness and tendency to violent reflex movements may be overcome by the application of cocaine, which is usually necessary in these cases.

Paræsthesia may result from hysteria, but is most commonly due to some slight cause of irritation in the pharynx. A foreign body may often lodge temporarily in the throat and produce a slight scratch, or there may be a tendency to dryness, and small black mucous crusts may be seen adhering to the mucous membrane. The greatest care should be taken before diagnosing the condition as a neurosis to exclude the presence of a minute or transparent foreign body, such as a fish-bone.

Neuralgia of the throat is most commonly associated with disease in the immediate neighbourhood. The pain may arise from a carious tooth, or may be due to a serious affection of the larynx or œsophagus. Great care must be taken to exclude disease in the lower part of the pharynx, especially malignant disease, which is often very difficult to recognise in its early stages.

The treatment of all these affections depends upon the accurate diagnosis of the case. When no cause can be found on repeated examinations the case should be treated on general lines as a neurosis.

NEUROSES OF MOTION.

Paralyses of the palate and pharynx are met with after diphtheria and in grave diseases of the brain and spinal cord, such as bulbar paralysis and syringo-myelia. The treatment depends upon the cause.

Spasmodic affections of the palate are met with in two distinct conditions. They may be due to slight irritation of the neighbouring parts, such as occurs in pharyngitis sicca or mild catarrh. In these cases the pharynx or palate is observed to be in rhythmic movement, like a nystagmus, often very rapid, eighty to one hundred and fifty to the minute, and the movement is associated with a clicking tinnitus, which is objective and audible to the bystander. A similar condition may be met with in grave cerebral diseases, such as cerebellar tumour, when it may be associated with ocular nystagmus. Various spasmodic movements in the pharynx may also be seen in paralysis agitans, tabes, and poisoning by certain drugs, such as lead and mercury.

The treatment depends upon the cause. When there is no organic nervous disease, suitable local treatment usually affects a cure, although the affection may persist for some months.

H. LAMBERT LACK.

NEW GROWTHS OF THE ORO-PHARYNX.

Benign Growths, such as papillomata, small fibromata and lymphomata are not amenable to any treatment other than surgical, but are readily removed under local anæsthesia with biting forceps, or they may be clipped off with long scissors while traction is made with any sort of long seizing forceps. A snare is less desirable. A 4 per cent cocaine hydrochloride solution on a small pad of cotton, held in contact for a few minutes, produces ample analgesia. Before any pharyngeal operation, carious teeth should be filled or extracted and the mouth should be thoroughly cleansed with a toothbrush and 25 per cent alcohol. The hæmorrhage is usually slight and easily controlled by torsion of the bleeding points with long hæmostats (Fig. 1), or if the vessels have retracted so as to leave only oozing apparent, pressure with a gauze sponge held with the long hæmostat or any long forceps, or even with the finger, will arrest the bleeding. The wound is dusted daily with thymol iodide from an insufflator. The surface soon becomes coated with a greyish fibrinous exudate closely resembling a diphtheritic membrane in appearance. Large fibromata are apt to contain large vessels which contract imperfectly, especially if severed, not in the normal base, but through the fibromatous tissue. Such growths, and also large angiomata and fibro-angiomata, especially those near the base of the tongue, involve serious risk of hæmorrhage which must be forestalled, by preliminary ligature of the entire stump in case of pedunculated neoplasms, and by preliminary ligature of the external carotid artery in case of sessile growths. When ligature of the

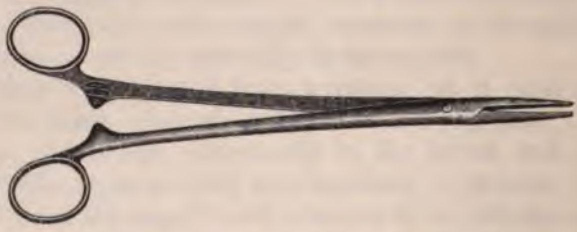

FIG. 1.—Long hæmostat for faucial and pharyngeal use.

in the wound to forestall secondary hæmorrhage is feasible, nporary common carotid compression of Crile gives a clear r operation. Tracheotomy and tamponnement of the upper of the larynx are often necessary to forestall aspiratory onia and for general anæsthesia. Cysts and teratomata must rpated with sac complete if recurrence is to be prevented. growths of the lower pharynx are best removed by supra- or subhyoid pharyngotomy as described under malignant s of the larynx.

gnant Growths of the Oro-pharynx, fauces, and tonsils, vered very early, may be extirpated by the same means as growths, but the removal of apparently normal basic tissue e very wide and deep. It must be remembered that the tic leakage into the cervical nodes is early and rapid, and ration that does not contemplate following up lymphatic on should be advised. In any but the very smallest growths tter to attack externally by lateral pharyngotomy, clearing suspected lymphatics before opening the pharynx.

CHEVALIER JACKSON.

NEW GROWTHS OF THE LARYNGO-PHARYNX.

Benign Growths in this region when small are best removed under local analgesia, using long slender forceps such as Patterson's or Mosher's, through the self-illuminated slide speculum (Fig. 1).

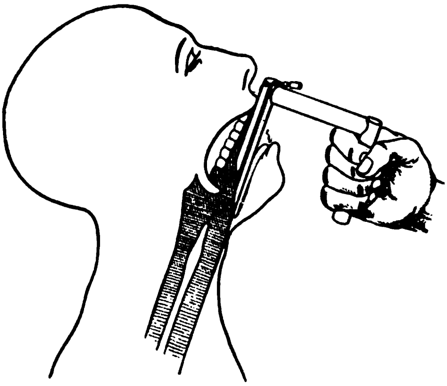

FIG. 1.—Self-illuminated "slide speculum" in position for removal of benign growths of the lower pharynx.

When large and vascular they should be removed by subhyoid pharyngotomy.

Malignant Growths in the lower pharynx should be removed by external operation, either lateral or subhyoid pharyngotomy.

CHEVALIER JACKSON.

NEW GROWTHS OF THE NASO-PHARYNX.

(*See* p. 699.)

PHARYNGOMYCOSIS.

Pharyngomycosis is a term often made to include keratosis of the pharynx in which the mycosis is merely more or less incidental and sometimes absent. Strictly speaking, it should be applied to cases where the whitish spots are definitely caused by the growth of organisms. Perhaps the most common mycosis is that produced by the leptothrix buccalis, a common saprophyte of the mouth, in which the spots appear on the soft palate and uvula and sometimes also in the mouth and pharynx proper. Another form, with its seat on the soft palate and oro-pharynx, is the mycosis sarcinica, in which sarcinæ are found. Yet another is the mycosis mucorina, where the organism appears on the pharynx and larynx and is said by some authorities to have relation to the affection known as black tongue. These mycoses are generally found in individuals with a lowered standard of health. The treatment should be concerned with improvement of the general health, which often causes their disappearance. When they are obstinate, application of chloride of zinc (20 gr. to the ounce), or peroxide of hydrogen, combined with an alkaline wash or gargle, will often prove successful in curing them.

D. R. PATERSON.

PEMPHIGUS OF THE PHARYNX.

Pemphigus of the mouth and pharynx usually runs a very chronic course in spite of all treatment, and death takes place from exhaustion or from an intercurrent disease to which the difficulty in taking nourishment predisposes. Antipyrin is reported to have produced pemphigus or a similar affection.

The mouth should be kept clean by the use of non-irritating washes containing, *e.g.*, glycerine of boric acid, hydrogen peroxide, or tincture of myrrh. Specially troublesome patches may be touched with a solution of silver nitrate (gr. 10 to 50 ad ℥j) or with tincture of iodine. If it is necessary to relieve pain at mealtime the tender areas may be painted with alypin solution (gr. 25 ad ℥j) or dusted with anæsthesin, pure or mixed with bismuth.

Arsenic is lauded by some, and condemned as useless or even harmful by others; it should, however, receive a trial, preferably as Fowler's solution. No special superiority is claimed for atoxyl. The general health should as far as possible be maintained; milk has been highly spoken of as an article of diet in this disease.

Ulceration of the soft palate and opposing surface of the posterior pharyngeal wall is apt to be followed by adhesion, so that the naso-pharynx is shut off; this should be anticipated and the parts kept separate by the occasional passage of a bougie or forceps. Similarly, ulceration around the mouth may lead to its contraction and almost complete closure, as in a case of the writer's; surgical measures are then necessary.

A. BROWN KELLY.

RETRO-PHARYNGEAL ABSCESS.

THE term "Retro-pharyngeal Abscess" is sometimes applied indiscriminately to any collection of pus in the posterior wall of the pharynx. Strictly speaking, its use should be limited to an abscess which has formed in the retro-pharyngeal space, *i.e.*, the space lying in front of the pre-vertebral fascia. Abscesses which may simulate the true retro-pharyngeal abscess occasionally develop (1) immediately beneath the mucous membrane, in front of the retro-pharyngeal space; (2) from caries of the cervical vertebræ, behind the pre-vertebral fascia; or (3) from suppuration in the lateral glands of the pharynx, to the side of the retro-pharyngeal space. As the treatment depends upon the place of origin of the suppuration it is important to locate this correctly.

The procedures to be adopted in the three conditions referred to may be indicated briefly. In (1) the treatment is the same as for retro-pharyngeal abscess. In (2) no opening should be made in the mouth, the purulent collection should be approached through an incision made at the posterior edge of the sterno-mastoid, and thoroughly cleared out, together with all the accessible diseased bone; the spinal caries should receive appropriate treatment. For cases falling under (3) it is usually recommended to make an external incision; in several adults, however, the writer has obtained a speedy and satisfactory issue by opening the abscess in the pharynx and exercising pressure over the fluctuating swelling in the neck. In making the incision it should be remembered that this form of abscess tends to push the adjacent large vessels of the neck towards the pharynx.

True retro-pharyngeal abscess, unlike other collections of pus that may simulate it, is fairly common in infants but rare in older children and adults. It usually develops rapidly, so that in the course of a day or two the obstruction to buccal and nasal respiration and to deglutition becomes pronounced, and may threaten suffocation and starvation. The abscess should therefore be evacuated as early as possible.

This may be accomplished by opening the abscess from the pharynx, or by reaching it through an incision made at the anterior or posterior border of the sterno-mastoid. The latter method requires a general anæsthetic, is more difficult and more apt to be followed by complications than the former, which experience has proved to be easy, safe and satisfactory.

A bistoury is selected, and the blade enveloped to within a quarter of an inch of its point, in gauze or adhesive plaster so as to safeguard against too deep penetration. In adults cocaine should be applied, but in infants neither chloroform nor cocaine is advisable, the preservation of the cough reflex being of importance. The abscess may be opened under guidance of the eye or finger. The former is preferable when a forehead reflector is available. By palpation, however, the situation and size of the bulging can often be better determined. A puncture is made in the most prominent spot and as near the middle line as possible. The child is at once inverted so that the pus escapes by the mouth. The opening should afterwards be enlarged downwards to the lowest part of the abscess so that there may be no retention. A sudden large gush of pus is to be avoided owing to the danger of flooding the lower air passages and causing asphyxiation or pneumonia. The infant should be kept under observation for several days while there is the possibility of re-accumulation. No further local treatment is needed. In a few cases the infection giving rise to the abscess has been traced to otitis media; the possible presence of the latter should therefore be kept in view.

A. BROWN KELLY.

SYPHILIS OF THE PHARYNX.

No special local treatment is required in those rare cases in which the primary sore occurs in the pharynx beyond insufflations of orthoform to its surface when there is much pain.

During the secondary stage it is of the greatest importance to remember that, unless every care is taken to remove all sources of irritation from the mouth and pharynx, mucous patches and ulceration may persist and recur in spite of the most efficient general treatment. Smoking is, perhaps, the most frequent cause of such trouble, and must be absolutely prohibited. Dental caries must be arrested, a tooth-brush used after each meal, and the mouth cleansed with a 1½ per cent. solution of chromic acid in water, or with the following mouth wash: ℞. Potass. Chlorat. gr. 10; Ac. Hydrochlor., Dil., ♏5; Lot. Hydrarg. Nigr.; Aquæ, of each, ℥ss. The diet must be simple and must include neither alcohol nor highly-spiced foods. Superficial ulcers or mucous patches should, after careful drying, be painted two or three times a week with a 2 to 4 per cent. watery solution of chromic acid, or, if they are very resistant, with solid chromic acid fused to a probe, the surface being afterwards touched with a 10 per cent. solution of silver nitrate in order to form a protective scab (Lieven). It should be remembered that not only is a mercurial stomatitis no indication of an energetic action on the syphilis, but the irritation which it causes may actually hinder the disappearance of the local manifestations of the disease. Under such circumstances it is sometimes useful to have resort, even in this stage, to iodide of potassium in the intervals between the courses of mercurial treatment. Occasionally, patients with secondary lesions of the mouth and pharynx are in such poor general health that they do not tolerate either mercury or iodides. Such cases should at first be kept at rest in bed while every effort is made to improve their general condition by means of good feeding, attention to the bowels, and the administration of tonics. Later, mercury should be given by inunction or subcutaneous injection.

In the tertiary stage, when ulceration is present, local treatment is not as a rule required beyond attention to the hygiene of the mouth. If, however, the ulcers are slow to heal, they should be stimulated by daily applications, after careful drying, of the following solution: ℞. Cupri Sulphat., gr. 20; Glycerini, ʒij; Aquam, ad ℥j.

Ulceration is sometimes especially obstinate on the posterior pharyngeal wall where the vascularity is poor, and healing may then be hastened by painting the raw surface with tinct. iodi. After the subsidence of the active disease, the tonsils may remain enlarged and indurated, and require to be removed. Small perforations of the soft palate may be induced to close by application of the galvano-cautery to their edges, or closure may be brought about by means of a plastic operation, which should, however, be deferred until at least a year after healing. When complete adhesion has taken place between the soft palate and the posterior pharyngeal wall, separation may be obtained by an operation such as that advocated by Spencer, but should only be attempted when there is reason to suppose that the palate still contains muscular tissue, so that subsequent closure of the nasopharynx during deglutition will be possible.

THOMAS GUTHRIE.

TUBERCULOSIS OF THE PHARYNX.

It is probable that, in young people, tubercle bacilli can pass through the tonsils to infect the cervical glands without producing any clinically apparent lesion at the site of entry. Again, secondary infection of the tonsil is common in patients suffering from pulmonary tuberculosis, and was found by Walsham[1] in twenty-one of thirty-six autopsies. It is generally only discoverable by microscopic examination. These two forms are therefore latent, and do not call for consideration here. Clinically an apparently primary tuberculosis of the tonsil also occurs, though extremely rarely, and should be treated by very complete excision, usually by enucleation.

The only form of pharyngeal tuberculosis which is at all common clinically is, like that of the larynx, secondary to pulmonary tuberculosis; but, unlike the laryngeal affection, it only occurs in a late and advanced stage of the pulmonary disease. The pharyngeal wall, faucial pillars, tonsils and soft palate are all liable to infection. Ulceration occurs early and tends to spread widely but superficially. A deposit of miliary tubercle is sometimes seen in the soft palate. These pharyngeal lesions are a sign that the general infection is very advanced and that the patient's resistance is thoroughly broken down; the prognosis is, in consequence, very grave.

The treatment is therefore only palliative, and resolves itself into the relief of dysphagia, for these ulcers are exquisitely sensitive. The provision of a bland and unirritating diet requires careful attention. Orthoform should be freely used, as an insufflation of 3 to 5 gr., and in the form of a lozenge containing 2 gr.; insufflations of anæsthesin may be employed instead, or the two drugs may be combined. As these patients have seldom long to live, there is less objection to the exhibition of cocaine and morphine than in most cases of tuberculous laryngitis. The former is given as a spray or applied directly to the ulcer with a mop, beginning with a 5 per cent. solution, but the strength will usually have to be increased later. Morphine is best used as an insufflation in doses of $\frac{1}{4}$ gr., diluted with starch or bismuth; it may also be given in the B.P. lozenge containing $\frac{1}{36}$ gr., and in the worst cases hypodermic injections are necessary half an hour before food. Great relief can often be given by various methods which destroy the sensitive nerve endings: the application of solid nitrate of silver, rubbing in Lake's mixture of lactic acid (50 per cent.), formalin (7 per cent.), and phenol (10 per cent.), under cocaine anæsthesia, or by the superficial application of the galvano-cautery. But when the ulceration is moderately localised the best results are to be obtained by the use of the curette under cocaine, a procedure which usually renders such ulcers much less sensitive, delays their extension and occasionally produces local healing.

HAROLD BARWELL.

REFERENCE.

[1] Walsham, "The Channels of Infection in Tuberculosis," London, 1904.

ULCERATIVE PHARYNGITIS.

Ulceration in the pharynx, unless due to one of the infective diseases, is rare. Various simple ulcers have been described, some of these merely mark a stage in the course of an underlying affection, while the pathogenesis of others is not yet understood. In the present state of our knowledge it is convenient to group all the simple ulcers of the pharynx under the above heading.

When a case of ulceration in the pharynx comes under observation, the possible presence of an infective disease and especially of syphilis should be kept prominently in view. If, however, there is no evidence of such disease, it is a great mistake to "try specific treatment." Most of the forms of ulceration referred to below heal of themselves in a short time, but if anti-syphilitic remedies have been given it is impossible to determine the part they may have played in effecting the cure. One is then uncertain whether to stop or continue the specific treatment, and without a good reason the patient may be subjected unnecessarily to a prolonged course of medication, or, on the other hand, the opportunity of combating the disease in its early stages may be lost. When in doubt, therefore, wait and, at the most, treat the symptoms only. Usually within two or three weeks simple ulcers heal or improve markedly, while those due to syphilis persist or get worse.

Herpes has been already mentioned as giving rise to ulcers which may resemble excoriated mucous patches. In pemphigus the bullæ are rarely seen and the ulcers are readily regarded as syphilitic. In the later stage of ulcero-membranous angina marked ulceration may be observed (p. 771).

Acute ulcerative lacunar tonsillitis is confined to the tonsil and develops from within towards the surface; in both these respects it differs from ulcero-membranous angina. For the former, Moure recommends the application of zinc chloride (gr. 30 ad ℥j) to the parts, an alkaline gargle and general tonic treatment.

Angina ulcerosa benigna is characterised by the presence of a small, solitary, superficial ulcer or excoriation on the upper part of one, or rarely both, anterior faucial pillars. It may cause considerable pain. Healing takes place in from ten to twelve days. In the writer's opinion this affection is of herpetic origin and should be treated as such.

Diabetes has been the cause assigned by Freudenthal in several cases of pharyngeal ulceration. This writer has also described certain ulcers in the pharynx as probably of rheumatic origin owing to their rapid improvement under anti-rheumatic treatment.

Pneumococcus infection may lead to extensive and deep ulceration, causing even perforation of the palate.

In erythema exudativum multiforme nodular infiltrations may form in the mucous membrane and by necrosis give rise to superficial ulcers; as a rule, their nature is recognised from the accompanying skin manifestations.

Leukæmic patients may present ulcers in the pharynx with or without infiltrations.

In ulcerative pharyngitis antiseptic gargles or lozenges should be prescribed. Healing may be encouraged by painting the ulcers with a solution of silver nitrate or chromic acid (10 per cent.). The pain may be relieved by anæsthesin insufflations or other of the sedatives recommended in acute pharyngitis. Any underlying constitutional disease should receive attention.

A. BROWN KELLY.

DISEASES AND AFFECTIONS OF THE TRACHEA.

THE trachea participates in many acute and chronic inflammatory conditions of the larynx, and bronchial tubes. In most of these no special treatment for the tracheal condition is required.

INJURIES OF THE TRACHEA.

THESE include scalds, wounds, ruptures and foreign bodies in the trachea. The latter is dealt with under the heading of Foreign Bodies in the Air Passages (*see* p. 803).

Scalds of the trachea have no treatment apart from scalds of the larynx, with which they are always associated.

Wounds of the trachea are usually the result of "cut-throat." If clean cut and not causing too much loss of substance, the wound in the trachea should be sutured. The skin wound may also be partially closed, sufficient drainage being provided to prevent the possibility of blood or pus being pent up and finding its way into the trachea.

Rupture of the trachea may occur from violent blows or wrenches of the neck, when the latter is in a position of over-extension. Rupture is usually complete and the ends retract, leaving a gap. Operative exposure of the trachea is urgently required. The separated ends should be brought together with sutures and tracheotomy performed, a rubber tube being inserted down the trachea to reach below the site of injury. The operation for exposing the trachea is often rendered difficult by the infiltration of the cellular tissues with blood and air.

G. WILKINSON.

INFLUENZAL TRACHEITIS.

Several cases have been reported in recent years in which hæmoptysis occurring after influenza has given rise to a suspicion of pulmonary tuberculosis, but in which careful examination has shown that the bleeding was coming from the trachea. The treatment consists in rest, the administration of opium and ergot, and ice to suck. After the acute attack an astringent spray, such as the following, may be ordered: Hazeline, ʒj ; Chloretone, gr. 3; Glycerini, ʒj; Aquam, ad ℥j. Tonics, such as strychnine and cinchona, should also be given.

Inflammation of the tracheal mucous membrane is often a factor in the persistent cough of influenza. The following spray will be found useful if inhaled deeply: Menthol, gr. 5 ; Cocaine, gr. 5 ; Acid. Carbolic., gr. 3 ; Chloretone, gr. 5; Paroleine, ad ℥j. M. J. Glover recommends quinine, given internally, 12 to 15 gr. daily.

G. WILKINSON.

TRACHEAL FISTULÆ.

Congenital fistulæ open externally along the inner border of the sterno-mastoid. They should be excised throughout their entire length by careful dissection. A probe should be introduced along the fistulous track as a guide.

Acquired fistulæ are the result of wounds of the trachea, surgical or suicidal. If small, destroying the edges with the galvano-cautery may suffice, or the margins of the track may be excised and the opening sutured. For larger fistulæ a plastic operation will be required. Killian recommends the following operation: The margins of the fistula are thoroughly excised. A vertical incision is made through the skin on either side of the fistula and about 2 centimètres distant, and the skin between the incisions and the fistulæ undermined. The tracheal wound is sutured with catgut, and the bridges of skin are brought together in the middle line and sutured, so as to cover the deep line of sutures.

When the opening into the trachea is large it cannot be sutured without narrowing the lumen of the trachea. Gluck's operation is suitable for these cases. A small lateral flap is turned over and covered by a larger flap from the opposite side. The deeper flap should, in male patients, be taken from the skin over the lower part of the neck, otherwise a growth of hair may appear later upon it, within the trachea.

G. WILKINSON.

TRACHEAL OBSTRUCTION.

A NUMBER of tracheal conditions present themselves for treatment on account of obstructed breathing, either acute or chronic in onset. In these cases it is important to remember Gerhardt's maxim, that in tracheal obstruction the larynx does not move up and down with respiration, but when the obstruction is in the larynx, the latter makes violent respiratory excursions.

Acute obstruction may be due to a foreign body in the trachea, or in the œsophagus pressing on the trachea, ruptures, contusions, scalds, crusts in the trachea, gumma, invasion of the trachea by caseous lymphatic glands, abscesses, aneurysms, etc.; compression from without from acute swelling of the thyroid, or rapidly enlarging aneurysm of the aorta.

In very acute cases, where death from suffocation seems threatened, the surgeon will have no choice but to perform immediate tracheotomy. If the instruments are at hand, this should be followed by inspection of the trachea through the tracheotomy wound (low tracheoscopy). By this means a foreign body may be found and removed. If no foreign body is present, a stout rubber tube should be passed through the tracheotomy wound, down the trachea beyond the seat of obstruction, and retained until permanent measures for the removal of the cause of obstruction have been taken.

Chronic obstruction may be due to any of the causes enumerated above, with the addition of the following: New growths in the trachea, scleroma, compression from without by new growth (*e.g.*, cancer of the œsophagus, mediastinal growths), by enlarged glands, aneurysms of the aorta, innominate or carotid; abscesses, especially mediastinal spinal abscess.

In many cases an exact diagnosis is not possible without the use of the endoscope. In cases in which the breathing is much obstructed, tracheoscopy under general anæsthesia is not free from danger. This is particularly the case when the trachea is compressed by mediastinal new growths, abscesses, or thoracic aneurysm. In these cases cocaine anæsthesia alone should be employed.

Endoscopic methods have much extended the range of treatment of tracheal affections. Their chief application, of course, has been in the removal of foreign bodies. A number of cases of papillomata of the trachea have been treated by removal of the growths through the endoscope. In some cases the papillomata were situated at the bifurcation of the trachea. Paterson's long crocodile forceps are most useful in dealing with these cases. The removal of other forms of intra-tracheal new growths has been recorded in a few cases. Pus crusts sometimes form in the trachea in cases of ozena, or purulent rhinitis, and may give rise to serious or even fatal obstruction. The endoscope affords the best means of removing them.

Stricture of the trachea due to cicatricial contraction following injury, syphilitic ulceration, or the deposits of scleroma has been treated by dilatation with bougies passed through the endoscope.

Strictures, when very dense and resistant to dilatation, are better dealt with by low tracheotomy and intubation of the narrowed portion of the trachea through the tracheotomy wound. Mikulicz advocates glass cannulas for this purpose.

Gummata of the trachea are not infrequent, and may give rise to dangerous stenosis, perforation of the trachea, or cicatricial contraction. Energetic anti-syphilitic treatment is called for. Iodides should be given in doses commencing with 15 and increasing to 30 or even 40 gr. three times daily. Mercury should be given at the same time, either combined with the iodide, as liq. hydrarg. perchlor. (1 drachm to the dose) [U.S.P. hydrarg. chlor. corrosiv., gr. $\frac{1}{16}$], or by subcutaneous injection of a soluble preparation.

Compression from without.—If due to a foreign body in the œsophagus, this should be removed with the aid of the endoscope. Obstruction to respiration from pressure on the trachea is the most imperative indication for partial removal of an enlarged thyroid. In very severe obstruction, tracheotomy may have to be done, and the air-way kept open by a tube passed down the trachea to below the site of compression. The tracheotomy wound is, however, an awkward complication in the operation for the removal of the thyroid, which it is well to avoid, if possible. In many cases half the gland can be rapidly removed under infiltration anæsthesia, the operator being prepared to open the trachea at any moment if the breathing becomes very difficult. Occasionally the compressing portion of the thyroid is entirely sub-sternal, the cervical thyroid not showing any signs of enlargement. Diagnosis will have to be made with the endoscope and X-ray screen. The characteristic feature of the tumour, as viewed on the screen, is its movement with respiration. The operation for removal of sub-sternal goitre is a formidable procedure.

Tuberculous glands compressing the trachea must, of course, be removed. Malignant tumours must be removed when possible. If removal is not possible, tracheotomy, followed by intubation of the trachea, may sometimes be successful in prolonging life.

Abscesses should be opened and freely drained. Mediastinal spinal abscesses are the most difficult to deal with. A skiagram should be obtained. Guided by this as to the position of the abscess, the pus may be evacuated by opening the mediastinum from behind, after re-secting portions of one or more ribs, immediately external to their articulations with the transverse processes of the vertebræ.

G. WILKINSON.

REFERENCES FOR DISEASES AND AFFECTIONS OF THE TRACHEA.

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OREIGN BODIES IN THE AIR PASSAGES, WITH A DESCRIPTION OF BRONCHOSCOPY.

In hardly any branch of medicine, in the last few years, has iere been such a change as in the matter of foreign bodies the air passages. Whilst in earlier statistics the mortality in ises of aspiration of foreign bodies showed a terribly high per- ntage, at the present time it is an exception for anyone to die om such a calamity if suitable treatment is available.

For this we are chiefly indebted to our knowledge that the eper air passages can be rendered visible by direct methods and iat foreign bodies can be removed from them.

Before we examine the methods useful for this purpose more osely we will shortly recall what were the methods of treatment the disposal of physicians in earlier years. It is all the more cessary to do so in order to advise against some of these, especially they are still sometimes used for the sake of convenience.

In earlier years it was often recommended to take up a purely pectant standpoint, and appease the patient by hoping that the reign body might be brought up by coughing. According to the tistics of Kühn, who collected 374 cases from the literature, this ent occurred in eighty-three instances. The true proportion, wever, is probably even smaller.

Attempts were made to excite cough by giving a smart blow on e back, by shaking, or by giving an emetic. The great untrust- rthiness as well as danger of these procedures contra-indicate em. In certain circumstances, by violent paroxysms of coughing, reign bodies in the bronchi may become loosened and moved into e trachea; it also cannot be denied that they may pass into the rynx; but, on the other hand, the continual attacks of coughing eatly weaken the patient and may expose him to the danger of ath by suffocation. It is also to be remembered that as a result the deep inspirations which follow coughing the foreign body ay possibly pass deeper into the air passages and become more mly impacted.

In order to diminish the danger from spasm of the glottis it has en recommended first to chloroform the patients and then to p the back or shake them. But the fact that the glottic reflex is only abolished on deep narcosis and only after abolition of the corneal reflex makes this proposal inadvisable.

The observation that a dog, when a foreign body has passed into the air passages, bends its head low and coughs in violent paroxysms, has caused patients to be raised high by the feet or brought into a more or less inverted abdominal or dorsal position. But even this expedient does not avoid the danger of spasm of the glottis.

Those methods have proved themselves essentially more rational which have for their purpose either the seizure and extraction of the foreign body, or by operative measures the removal of all obstacles.

If the physician had not the necessary instruments at hand he could endeavour to remove foreign bodies in the larynx with his finger; a suitably curved forceps made the attempt easier, while the use of the laryngeal mirror gave him a distinctly better view. If removal was not successful, as a rule tracheotomy followed. An attempt was then made through the wound to free the foreign body and either, with simultaneous manœuvres from the mouth, to push it upwards or else to draw it downwards through the tracheotomy wound. If this failed, division of the cricoid, and even of the thyroid cartilage was undertaken. Smooth pieces of bone, buttons and coins could sometimes be removed by means of sub-hyoid pharyngotomy.

What could be done with foreign bodies lodged in the trachea and bronchi? If freely movable and continually loosened by fits of coughing, causing attacks of suffocation, tracheotomy was generally recommended. In a few isolated cases with small foreign bodies intubation has been of service. O'Dwyer prepared for this purpose special short and wide tubes which he never had the opportunity to use; but other observers[1] have found that foreign bodies can be either coughed up through the tube or become impacted in its lumen and then removed with it. v. Bokay also considers intubation of value with large movable bodies, when, if their removal is not possible, the necessary time is available to prepare quietly for tracheotomy. "It is indeed superfluous," says v. Bokay, "to emphasise the fact that a constant watch over the patient is absolutely indispensable, since the occurrence of impaction of the foreign body demands immediate extubation."

When the foreign body was impacted an opening into the trachea was carried out as near to the foreign body as possible,—a high tracheotomy when the foreign body lay in the upper section of the trachea and in the subglottic space, as low a one as possible when it was situated in the thoracic portion of the trachea or in the bronchi. If on opening the trachea no body was seen the mucous membrane

itated with a feather to produce coughing and drive it higher
this procedure did not succeed, slender forceps, hooks, wire
and similar instruments
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in, in 1895, made a further advance by the method called by
autoscopy." He originally made use of graduated tubes,

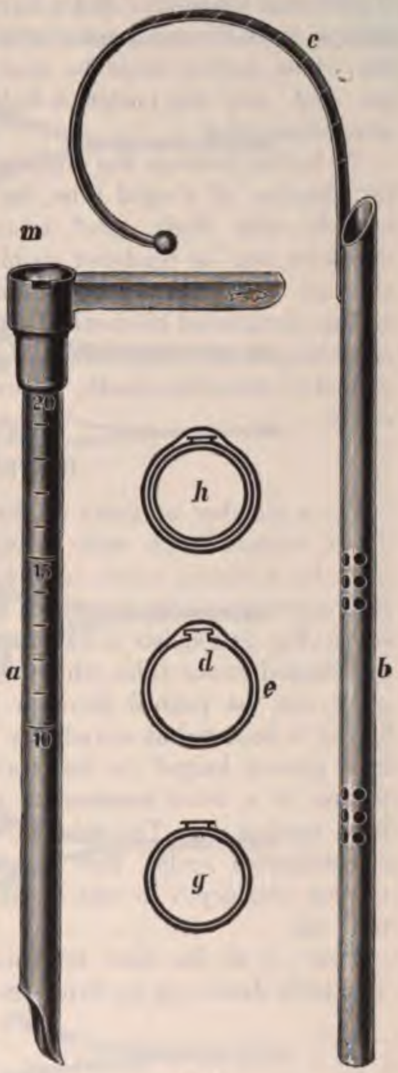

FIG. 1.
Brünings' bronchoscope. (For description of this figure, *see* p. 806.)

but soon changed to spatulæ, which were affixed to the base of the tongue. The latest form of these he has designated the "universal spatula." With Kirstein's instrument it was almost always possible to inspect the larynx in children. In adults the whole larynx could be seen in only 25 per cent., while in 50 per cent. only the posterior half, and in 25 per cent. the method altogether failed.

To Killian belongs the great merit of having shown that by the introduction of a rigid tube, the larynx and the trachea and both bronchi with their chief branches and even their secondary divisions, can be rendered visible in a majority of cases, not only through the tracheotomy wound but also through the mouth. Killian designated his method *direct bronchoscopy*, and distinguished, according as the inspection was undertaken from the tracheotomy wound or from the mouth, a *lower* from an *upper* direct bronchoscopy.

INSTRUMENTS.

For a number of years we have almost exclusively carried out direct examinations with Brünings' instrument, which was first used in Killian's clinic and has been well tried there. This instrument possesses a number of advantages. Brünings' bronchoscope (Fig. 1) consists of two parts: the tubular spatula (*a*), and the fenestrated inner tube, which, by means of a watch-spring attachment, can be pushed through the tubular spatula. The watch-spring is dentated at one edge in order to prevent slipping. It runs in a groove lodged in the wall of the tubular spatula, and, by means of a lever mechanism at the head of the latter, can be fixed against it. The tubular spatula bears on its outer surface a centimètre scale; this is also marked on the watch-spring, so that the depth to which the instrument is introduced can be read off.

Four, or at the most five, sizes are sufficient for all purposes. The table drawn up by Brünings shows the size of the tubes.[2]

No.	Diameter in mm.		Length of Spatula, cm.	Combined Length, cm.
	Outer Tube.	Inner Tube.		
1	12	11	20	40
2	10	9	18	37
3	8·5	7·75	14	30
4	7	6·25	11·5	23

In general, it may be said that the outer tube, which easily passes the larynx, reaches, when introduced as far as possible, to the lower half of the trachea, and the inner tube into both chief bronchi. In certain circumstances a small conical inner tube at the end is necessary. A pair of forceps capable of being lengthened with numerous detachable pieces makes a good extraction instrument (Fig. 2). These pieces are: (*a*) The claw forceps, which consists of two pairs of short sharply cut double hooks; (*b*) the bean forceps with fenestrated serrated blades; (*c*) the needle forceps, the rough

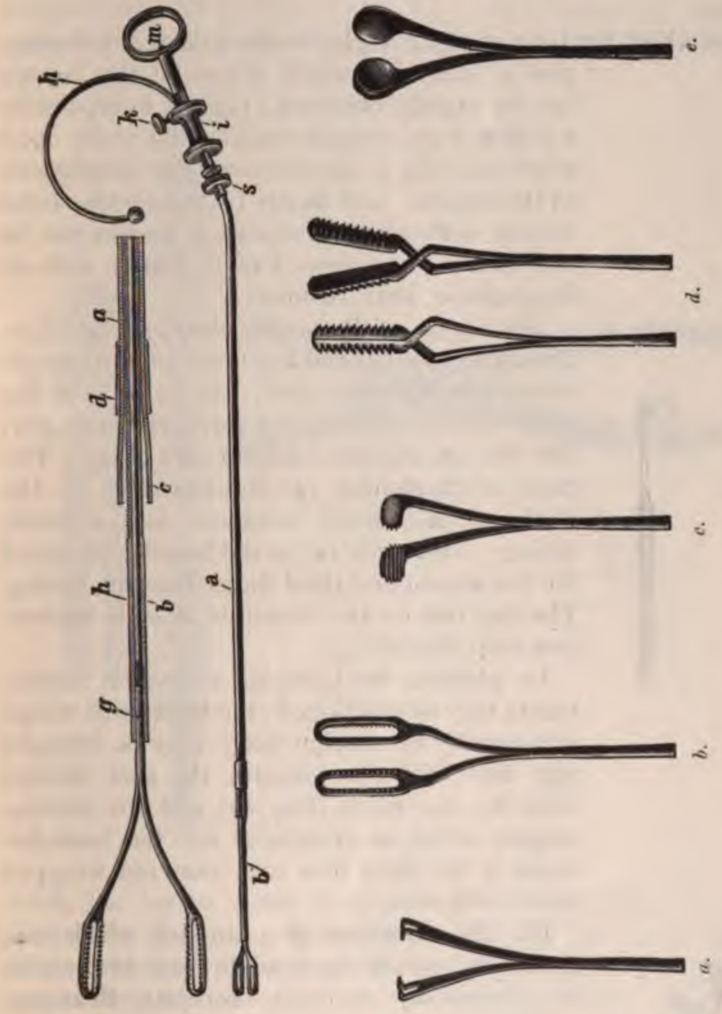

FIG. 2.
Brünings' forceps. (For description, *see* below and p. 808.)

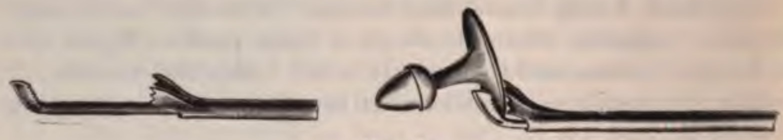

FIG. 3.

blades of which are bent at right angles to the axis of the forceps and by means of which closure of the forceps can be exactly observed; (*d*) the forceps with a hollow body, serrated outside, and which open when the tube is pushed over the attachment to the forceps; and finally (*e*) the double-spoon forceps with which granulation masses can be cleared away and small foreign bodies, such as fragments of nuts, removed.

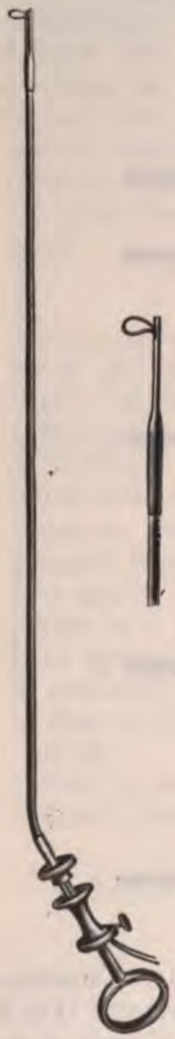

FIG. 4.

Description of Brünings' Forceps (Fig. 2).—The outer tube (*a*) and the inner tube (***b***) can be moved towards each other. At its end (***c***) the outer tube is divided and serrated internally. The bar (***d***) fixes the tubes to each other. The piece of attachment (***g***) is screwed on to the steel rod (***h***), which runs out into a watch spring. The screw (***k***) in the handle appointed for the second and third finger fixes the spring. The ring (***m***) for the thumb is in close connection with the tube (*a*).

In addition, the following extraction instruments may be mentioned: the hook, with which occasionally the foreign body may be brought into line with the forceps; the stud forceps (Fig. 3); the snare (Fig. 4); and the electro-magnet, which is introduced into the broncho-scope in the form of a long iron rod wrapped round with wire.

For the extraction of a tin-tack which was tightly lodged with its head directed downwards in a markedly stenosed bronchus, Brünings constructed a number of special instruments, which in future may prove themselves of use, and may therefore be shortly described. A graduated forceps without a handle (Fig. 5), in which the steel rod bearing the attachment piece is not, as is the case in the forceps (Fig. 2), elongated by a watch-spring, but remains as a graduated rod and is provided above with the knob (*a*). When the freely movable outer wall (*b*) is pressed against the knob (*a*) the forceps is shut. In order to carry this out properly, the forceps (*Z*) is added, its forked blades being caught in the groove (*c*). If the foreign body is seized, the socket (*g*) is screwed upwards until it touches the outer wall (*b*). The key (*s*) is used for the latter purpose. Over the closed forceps, the head of which is only 5 mm. thick, the hollow metal bougies (Fig. 6) are placed in turns to dilate the stenosis. Since, as a rule, the bronchus is dilated behind the stenosis, no harm is done if the foreign body is driven deeper into the bronchus; it can be brought out again without difficulty into its original position by means of the handleless forceps. Dilatation is accomplished by screwing forward the inner tube (Fig. 7) against the outer, which is divided at the end into a series of thickened segments conical internally. A thin tube is used for absorbing the masses of secretion, often abundantly present, and is pushed into the bronchoscope and connected

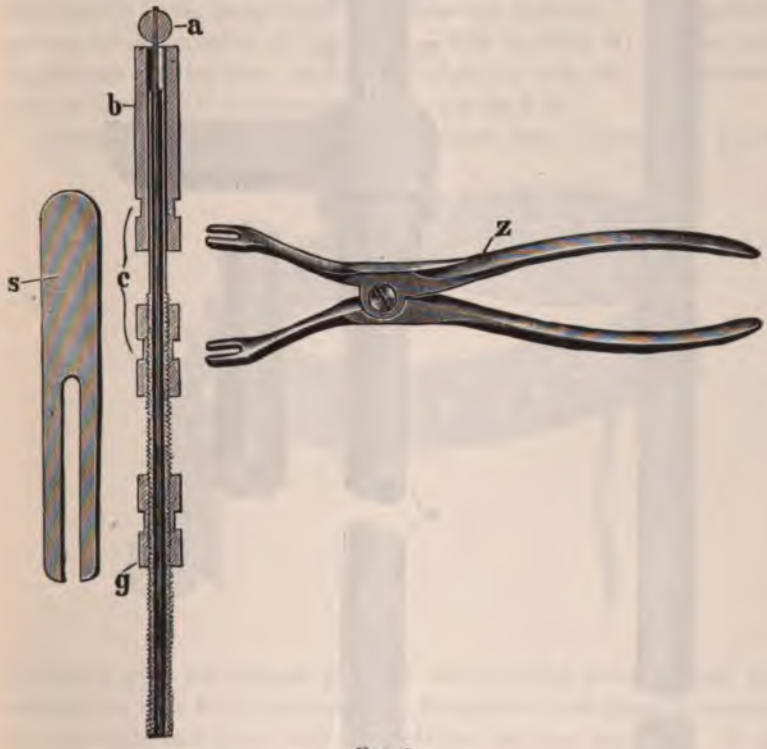

FIG. 5.

with a suction apparatus, air pump, or better with a strong jet of water.

Description of Brünings' dilatable Bronchoscope (Fig. 7).—(*a*) Outer tube ; (*b*) segments of the outer tube, which are thickened internally and conical ; (*d*) inner tube, which at its upper end bears a screw and shows on a scale to what diameter the dilatable end of the outer tube is opened.

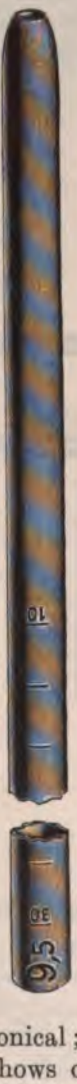

FIG. 6.

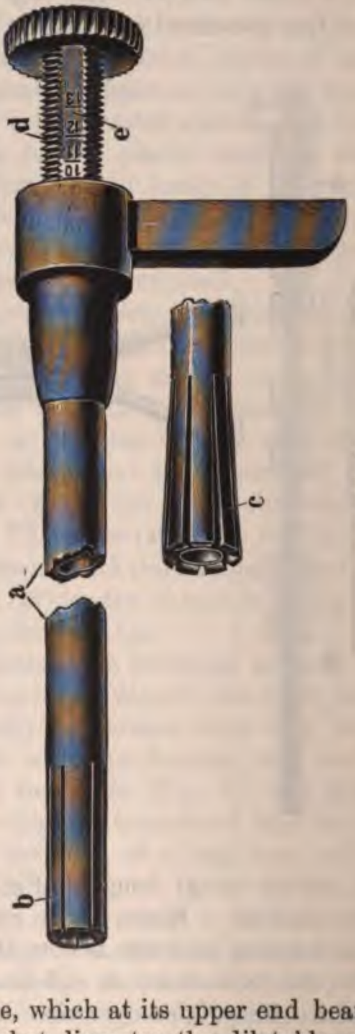

FIG. 7.
Brünings' dilatable bronchoscope.

For removing small mucous and purulent flakes graduated tampon holders are of use.

Description of Brünings' Hand Lamp (Fig. 9).—*n.m.* Axis of handle; *c.d.* axis of illuminator; *e.f.* visual axis. In front of the triple burner (*x*) the lens (*a*) is directed, which collects the light and throws it on the central perforated mirror (*b*). Through the ring (*z*) the lens is brought nearer the light or removed from it. The mirror is movable by the screws (*h*) and (*g*) in the visual axis *c.d.* and *e.f.*, and can, on becoming soiled, be brought into the position (*v*). The handle (*k*) can be turned and is inverted in the attachment (*l*) of the tube holder (*r*). The spring (*s*) on turning the handle back, fixes itself in the normal position. The socket (*p*) serves for connection of the wires. The contact (*o*) can be moved higher up and by that means the light is cut off. The telescope can be fixed with its attachment in the stud (*y*).

Kirstein's lamp (Fig. 8) and Brünings' hand lamp (Fig. 9), both of which give an almost parallel ray of light, have proved themselves the best for illumination. Kirstein's head lamp is connected by a double ball-joint with the circlet for the forehead. It gives with Brünings' triple burner (Fig. 10) just as much light as his hand lamp, and is of advantage to the examiner, in that he can move as far as necessary from the tube whilst introducing and removing the instruments. He can move also whilst the patient coughs without altogether shutting out the light. Brünings' hand lamp (Fig. 11), which is the foundation of Kirstein's, is intimately connected with the tube and provided with a telescope. In order to keep the rays of light in the axis of the tube, the perforated mirror can be moved by a screw. Soiling of the mirror by the coughed up secretion can be avoided by shifting the handle to the right or left, when the lumen of the tube remains free (Fig. 12).

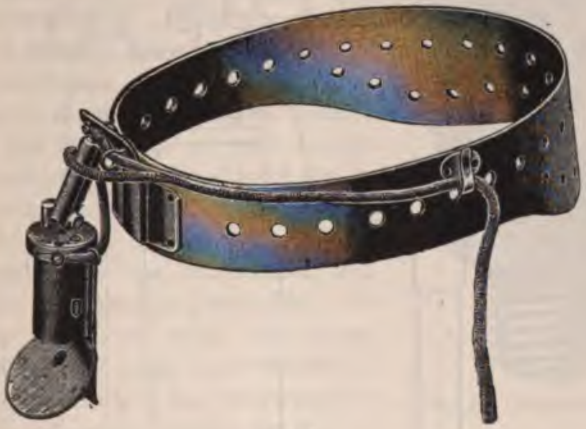

FIG. 8.

By gentle pressure the illuminator again returns to its original position. The power of turning the lamp with the handle permits inner tubes and other instruments to be introduced. In addition, the light can be withdrawn about 10 cm. from the handle in order to obtain a certain freedom of movement whilst manipulating with forceps. Brünings has lately replaced the hole in the mirror by a slit. Although this causes some loss of light, it has the advantage of allowing extraction instruments to be introduced without trouble. A well-constructed Brünings' lamp makes illumination easy for the beginner and renders good service to the practised hand, especially for purposes of demonstration.

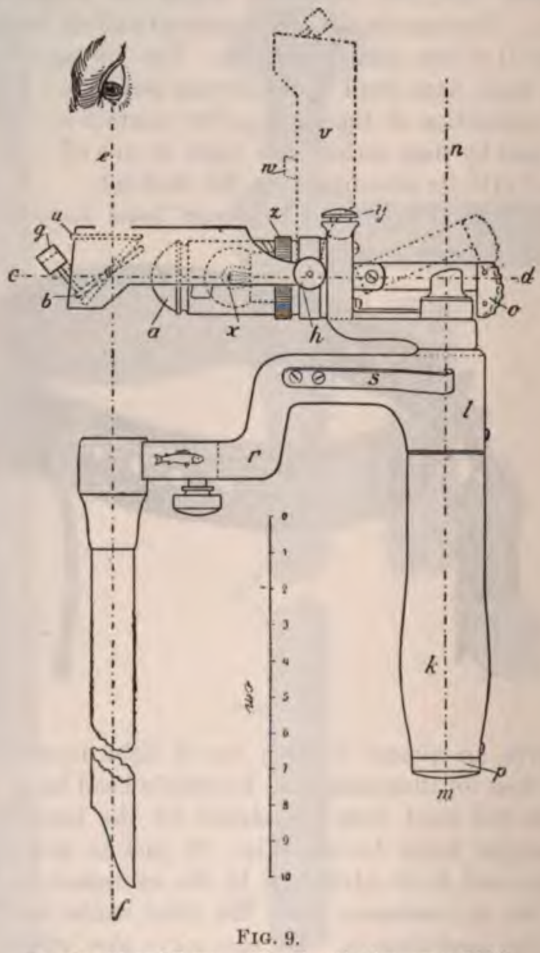

FIG. 9.
Brünings' hand lamp. (For description, *see* p. 811.)

GENERAL AND LOCAL ANÆSTHESIA.

It is necessary for the success of the direct method that the patient does not disturb our manipulations by involuntary movements. Adults as a rule possess sufficient intelligence and strength of will to bear the process of cocainisation and direct inspection. When circumstances do not demand immediate treatment a large dose of bromide (up to 6 grammes) the evening before examination is of use in excitable patients. The administration of codeine is to be recommended, especially in the case of foreign bodies which have been present for some time, as a preventive against violent coughing. A subcutaneous injection of morphia is quicker and more effective. If this should not quiet the patient sufficiently and there is not time to repeat the dose, narcosis remains as our last resource. We prefer chloroform as a general anæsthetic since the mucous membrane is much less excited by it than by ether. In cases of marked dyspnœa the inhalation of pure oxygen can be combined with the chloroform in suitable proportions.

In children we are seldom able to limit ourselves to local anæsthesia, and chloroform is generally preferable. On the other hand, we must not forget that children are much less tolerant of cocaine than adults; the same applies to the simultaneous administration of various poisons, such as morphia and atropine or morphia and cocaine, etc. We do not generally employ both the former remedies in the young and cocaine should be used only in the smallest doses. If this should not suffice we use less poisonous drugs, as alypin, novocain, etc.

FIG. 10.—Enlargement 3 : 1.

In adults as well as in children we almost always succeed with local anæsthesia when working through the tracheotomy wound, since the examination rarely makes a great demand on the patient's courage. Tracheotomy—we decidedly prefer superior to inferior tracheotomy for this purpose—can often be carried out in adults with local anæsthesia; in children it is better to give a general anæsthetic.

It is self-evident that we should carefully watch the general condition of the patient during the whole procedure, and have camphor or caffeine ready for subcutaneous injection if necessity arise. The marked analeptic effect of an intravenous injection of adrenalin should also be remembered.

TECHNIQUE OF THE DIRECT METHOD.

Position of the Patient. — For short examinations the sitting position is to be recommended, if salivation is not too abundant. In all other cases the lateral or dorsal position is the most advantageous. Small children can be held upright in the lap. Marked bending back of the head, which easily occurs in narcotised children, when the head hangs down over the head of the table, is to be avoided. The dorsal position is unpleasant in

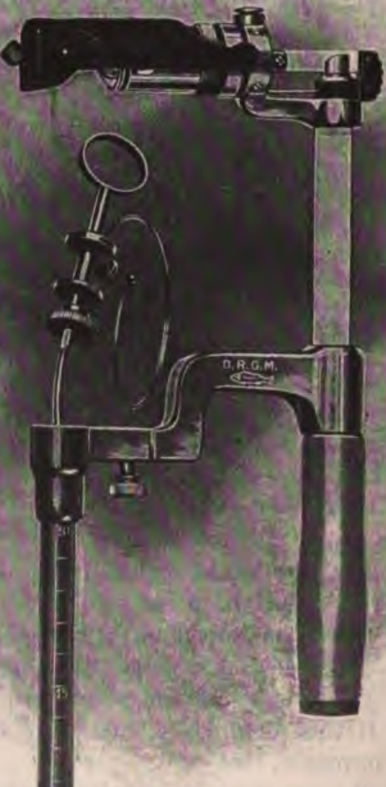

FIG. 11.

non-narcotised patients, since abundant secretion collects in the naso-pharynx and runs down through the nostrils over the eyes. The lateral position, which is also a good one in anæsthetised patients, has the advantage that the secretion continues to run out from the lower corner of the mouth.

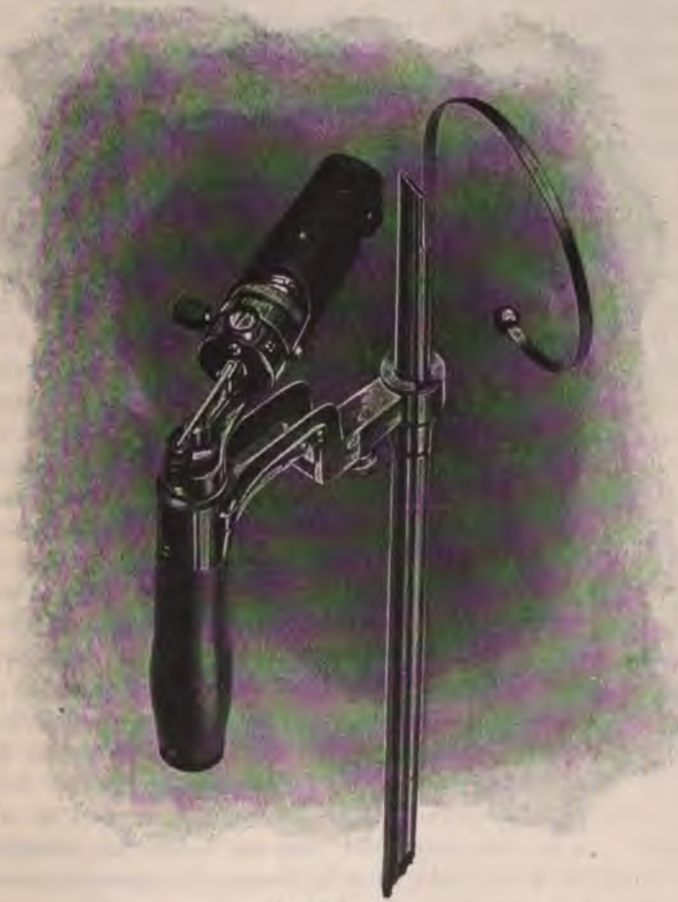

FIG. 12.

When bronchiectatic cavities, which frequently form in chronic cases, are present, it is advisable to place the patient half or one hour before the examination in a sloping, lateral position, the pelvis high, the thorax with the sound side below. In this position the bronchiectatic cavity empties the greatest part of its contents. We now examine the patient in the sitting posture, a position in which further excretion from the cavities either altogether ceases or is rendered very much more difficult.

Cocainisation.—Cocainisation of the air passages must precede direct inspection. We do this in non-narcotised patients with the help of the laryngeal mirror by introducing a 10 to 20 per cent. solution of cocaine, to which a few drops of adrenalin are added. This is best done by a flexible laryngeal sound, the bulbous end of which is rough and surrounded by cotton-wool. If after some applications to the laryngeal mucous membrane anæthesia is obtained, we pass the sound through the glottis. Finally the whole trachea and even the commencement of the bronchi can be cocainised if necessary. Since the reflex at the glottis and bifurcation only disappears on deep narcosis, we can never dispense with cocaine even in chloroformed patients. We apply this either with the cotton tampons described above for the larynx, under the guidance of the finger or with a straight tampon carrier by the direct method, after displacing the soft parts at the base of the tongue. For this purpose the angular spatula recently devised by Killian is especially suitable, as it presses more easily and deeply into the base of the tongue than the relatively broad one of Kirstein. A few minutes later we can introduce the tube into the larynx, and then, the tube being gradually pushed forward, we can see to apply the cocaine, by means of the graduated cotton tampons to the deeper sections. If no inflammatory irritation of the trachea occurs, no further anæsthetisation of this section is necessary, but this is often required at the bifurcation and at the orifices of the bronchi. The part surrounding the foreign body frequently shows marked reflex excitability as a result of inflammation and should be thoroughly cocainised with Brünings' spray apparatus for the bronchi.

Introduction of the Bronchoscope.—The introduction of the tubular spatula into and through the larynx is the most difficult part of direct examination. The head of the patient must be moderately bent backwards, and the mouth opened as wide as possible. The non-narcotised patient holds his stretched-out tongue tightly in his right hand by means of a piece of gauze. In narcosis any drawing forward of the tongue is usually superfluous, and especially in children, disadvantageous. The tubular spatula is slightly warmed and lubricated with liquid paraffin before its introduction. Direct contact of the tube against the teeth and pinching of the upper lip between the tube and the teeth are to be avoided. It is well to insert the index finger of the left hand with the tube into the mouth, to encircle it from behind, and to increase the pressure on the root of the tongue.

The first and most important structure that comes into view is the epiglottis, the oral surface and free border of which are seen when we introduce the tube and press it forward and downward over the middle of the tongue. We now endeavour with the point of the tubular spatula to pass over the free border of the epiglottis, but must avoid pushing the tube further downwards. We only do this when, after displacing the epiglottis at the root of the tongue by a succession of rotatory movements of the tube, we have seen the ary-epiglottic folds and the posterior, and finally the anterior parts of the vocal cords. We now press forward to the level of the glottis and pass it, whilst we introduce the spatula end into the region of the posterior commissure, and by depressing and at the same time pressing forward the instrument we open the vocal cords so wide that the whole end of the tube passes into the subglottic space. The point of the tubular spatula can also be placed edgeways and made to enter the closed glottis, when by turning the tube 90 degrees, with simultaneous depression, it will pass the vocal cords. On passing further down we must be careful that a certain extent of free lumen exists in front of the end of the tube, and also that the direction of the trachea accords with that of the tube. After passing the glottis, the tube being in the right direction and the patient in a good position, we frequently recognise the bifurcation, the orifices of the main bronchi, and the pulsations of the aortic arch in the lowest segment of the left tracheal wall. If we insert the spatula as far as it will go, we see, as a rule, a good distance into the right bronchus, whilst only the median circumference of the first bronchial rings of the left are visible. This is due to the unequal size of the angles which the bronchi form with the trachea. In order to inspect the deeper bronchial sections and their twigs we must introduce the inner tube through the tubular spatula. This does not require any great pressure. We recognise first the bifurcation between the middle and lower lobular bronchial tubes and then the breaking up of the bronchi into their smaller branches. On the left side we must press the outer wall of the bronchus and trachea somewhat more to the side in order to make the axis of the tube conform with that of the bronchus. At a distance of 4 to 5 cm.—this depends on the age—beyond the bifurcation of the trachea we see the two divisions of the bronchial tube to the lower lobule, and, with rotatory movements, further bifurcations of the bronchial tree.

Special attention is necessary to discover the bronchus to the upper lobe. On the right this branch diverges to the outer side of the bronchial stem, close to the bifurcation of the trachea ; we must carefully follow with the bronchoscope the rings in the outer wall. These rings appear to be suddenly interrupted after the tube has been introduced about 1 to $1\frac{1}{2}$ cm. beyond the bifurcation. The point of division of the bronchus to the upper lobe appears as a lateral recess, and the almost right-angled bifurcation gives, in relation to the remaining bifurcations, a somewhat stumpy appearance. On the left side the bronchial stem divides much deeper down into both its chief branches. In order to see the bronchus to the upper lobe on this side we raise the tube forward and outward, having already recognised the branches of the bronchus to the lower lobe.

If the teeth in the upper jaw are well developed and preserved it is advisable to push the tube well back into the corner of the mouth, to the left if the right bronchus is to be inspected, and *vice versâ.* If we desire to illuminate both bronchi, it is not always possible to push the introduced tube past the incisors of the upper jaw from one corner of the mouth to the other. In such circumstances the tube must be withdrawn altogether after one bronchus has been inspected and then introduced from the other corner of the mouth into the bronchus of the other side.

It may be mentioned that occasionally it is difficult to find the tracheal bifurcation, since it sometimes lies hidden under the left tracheal wall. Without knowing it we come upon the right bronchus and seek in vain for a large median placed bifurcation. The landmark in such cases is the left tracheal wall, the rings of which are to be exactly followed. At the point where it appears to be broken, we have the divergence of the left main bronchus stem and with it in close proximity the bifurcation of the trachea.

The method of inspection of the deeper sections from the tracheotomy wound is evident from what has been said. When the tube is entering a bronchus the head of the patient must be turned towards the same side, which, we may note, prevents the chin from being in the way.

We can observe the part of the trachea which lies above the tracheotomy wound even as far as the vocal cords, not only from above but also directly from the wound. This examination, which is designated "retrograde" tracheo-laryngoscopy, we carry out either with a small nasal speculum or with a short tubular spatula. This must either have many apertures on its surface, or else on its short side, lying opposite the point, there should be a long cleft some millimètres broad, so that on introducing it the breathing is not interrupted.

Use of the Direct Method for Foreign Bodies.—A thorough examination of the patient must precede direct inspection; the laryngoscope, as well as percussion and auscultation, must be employed. In the case of foreign bodies of great density the use of X-rays must not be omitted; but it must be expressly emphasised that we can only recognise metallic bodies with any certainty in the photograph, as pieces of bone which are so frequently present only exceptionally show a distinct shadow.

It frequently occurs that the result of all methods of examination is completely negative, although the foreign body is still impacted in the air passages; we must then lay great weight on the history of the cases, which, as a rule, is sufficiently characteristic to make the diagnosis certain.

Employment of the direct method is indicated as soon as aspiration of a foreign body into the air passages is certain or probable. Foreign bodies in the larynx and the upper section of the trachea, so far as they can be removed under the guidance of the laryngeal mirror, are an exception to this rule.

Extraction should follow as soon as possible; in doubtful cases we must not wait until distinct morbid changes are set up by the foreign body, we have rather to anticipate their occurrence. Extractions should be performed as carefully as possible, and any use of force is to be avoided. Foreign bodies tightly impacted can usually be loosened by rotatory movements. Large ones should be drawn as near as possible to the end of the tube, smaller ones through the tube, smooth formations, as cherry stones, peas, smooth stones, etc., are not unfrequently coughed up through the tube. Occasionally we have to do with many foreign bodies, as nut-shells and fragments of the kernel of nuts. We must not limit our inspection to one bronchus, but must most carefully examine both, even to their ramifications.

If a foreign body is not found in the bronchus on the side where we expect to find it on the ground of physical and other symptoms, the other bronchus must be inspected, since the body may in the meantime have passed from one side to the other.

The question what circumstances should guide us in determining whether to proceed by *vias naturales* or by the tracheotomy wound is the subject of much debate.

Some authors consider that primary tracheotomy with inferior bronchoscopy is the superior method, since in the first place the procedure is easier, and secondly, because it alone conforms to the rules of asepsis. The first reason is without doubt true, but it is not binding on one who understands how to overcome difficulties, since there is no doubt that removal by the mouth is by far the more elegant method, and leaves behind it no visible trace. Still less convincing is the second reason; every foreign body takes out of the oral cavity a large quantity of various germs into the deeper parts. From this rule even the pieces of bone cooked beforehand in soup are no exception; on the contrary, they are among the formations which most quickly lead to the production of pus. We have, therefore, to look on the air passages as infected before tracheotomy. Should the first attempts at extraction following immediately after tracheotomy lead to no result, as frequently happens when the conditions are difficult, we must wait a certain time. After a few hours an open tracheotomy wound can no longer be looked upon as free from germs. In further attempts at extraction we have therefore no more favourable conditions than when introducing a tube by the mouth. Finally, the experience, obtained in the case of a great number of foreign bodies removed by superior bronchoscopy, that all inflammatory appearances rapidly disappear, if only the *causa peccans* is removed, does not support the idea that there is greater danger in this method.

When there is marked and threatening dyspnœa, tracheotomy is certainly indicated, whether the foreign body, which cannot be removed without further trouble, is fixed in the larynx, subglottic space, or in the trachea or bronchi. This is especially the case if the condition has lasted some time and has exhausted the patient. Exceptionally the administration of pure oxygen can help us over the crucial moment. In the case of unusually large foreign bodies with prickly processes or hooks we prefer to operate through the tracheotomy wound, since the danger exists that they may become impacted either in the subglottic space or larynx, or produce severe lacerations of these structures, with the necessity for subsequent tracheotomy.

In the case of beans which have been some hours in the air passages, tracheotomy is likewise called for, since these foreign bodies swell up in a short time and become soft. They may crumble in the attempt to remove them by superior bronchoscopy, and we have then no longer to do with one but a whole number of foreign bodies—or they may become arrested in the subglottic space and then be aspirated into the bronchus and into the other lung which alone is still functionally healthy.

In the case of any large foreign body in the bronchus it is advisable to consider whether critical conditions may not arise during extraction or later. The decision whether primary tracheotomy should be performed depends on the wish of the patient or his relations, on the knowledge and trustworthiness of the assistant, and finally on the experience and boldness of the operator.

The delicacy of the technique of bronchoscopy has improved year by year, and increasing experience has resulted in the number of cases of foreign bodies for which tracheotomy must be undertaken being decidedly diminished. We should always be prepared for tracheotomy, as there will always be cases which offer such technical difficulties that we can only achieve our purpose by this means.

CARL VON EICKEN.

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DISEASES AND AFFECTIONS OF THE LARYNX.

ANÆMIA AND HYPERÆMIA OF THE LARYNX.

Although it has hitherto been usual to speak of anæmia of the larynx as though it was a clinical entity, the term should be abandoned unless it is used in a general way as one speaks of an anæmic conjunctiva as indicative of a general anæmia or of some underlying dyscrasia. The term has some clinical value because a peculiar wax pallor of the whole larynx is prone to appear in the early stages of laryngeal tuberculosis; but while mere pallor lends support to the suspicion of tubercle based on other indications, it should be remembered that the earliest manifestation of a developing laryngeal tuberculosis is just as often the reverse condition of hyperæmia. Hyperæmia of the larynx itself, apart from laryngitis, has no clinical significance. It is noteworthy that the laryngeal mucosa is unusually red in some healthy individuals, more particularly with bass voices, and the vocal cords in such persons may be distinctly red as a normal condition.

P. WATSON-WILLIAMS.

DISEASES OF THE CRICO-ARYTENOID JOINT.

These are recognisable only in as much as they produce more or less immobility of the vocal cord. Fixation may be due to disease within the joint (true ankylosis) or to diseases of the structures around the joint (spurious or false ankylosis).

An acute arthritis may, though very rarely, be diagnosed in the course of rheumatic fever and yield to treatment by the salicylates, but far more often fixation of the cord results from perichondritis, tuberculous laryngitis, syphilis, or malignant disease. Fixation also follows long-continued paralysis of the recurrent laryngeal nerve. The cord is usually fixed in the cadaveric position, between the middle line and the normal position of rest, but it may be in any position. If it is in the middle line the voice is but little affected. Dyspnœa only occurs when both cords are fixed and unable to abduct. The only treatment possible is that directed to the relief of dyspnœa, if this symptom is present. Tracheotomy only is available when the fixation is due to tuberculous laryngitis or malignant disease, unless the latter is capable of extirpation. Cicatricial fixation, *e.g.*, the result of quiescent syphilis, may be treated by dilatation with Schrötter's bougies or by intubation over a prolonged period with or without tracheotomy (*see* Laryngeal Stenosis). Any attempt to relieve the obstruction by excision of a vocal cord is certain to be attended by failure, for a new cicatricial band quickly replaces the excised structure.

HAROLD BARWELL.

HÆMORRHAGE FROM THE LARYNX.

BLEEDING from the vessels of the larynx may be sub-mucous or the blood may escape from the surface, hence it is useful to group cases under two heads: (1) Extravasations which are sub-mucous, called internal hæmorrhages, and (2) extravasations which are on the surface, called external hæmorrhages.

When the blood remains sub-mucous it may form a broad reddish streak running along the surface of a vocal cord, or become diffused so as to resemble a diffuse malignant infiltration or a tuberculous lesion. In other parts of the larynx it may form a bluish-red patch or patches or it may be large enough in amount to form a more or less semi-globular tumefaction, then being easily mistaken for a malignant neoplasm.

External hæmorrhages are fairly common in acute catarrhal laryngitis, and also occur in laryngitis due to influenza or typhoid fever. The quantity of blood is usually very small, amounting to streaks mixed with expectoration, or perhaps to a drachm. Occasionally the loss of blood is considerable, but this very rarely happens, and is then generally due to ulceration of a syphilitic, tuberculous or malignant growth, or else to some underlying dyscrasia, *e.g.*, leukæmia, purpura, renal disease or general arterial degeneration.

When hæmorrhage is slight no treatment is necessary, but with considerable hæmorrhage clots may collect, causing respiratory obstruction and requiring removal either by vigorous coughing or by means of a brush or forceps.

Slight sub-mucous hæmorrhage may be left to be absorbed. Larger tumefactions may have to be removed like any other laryngeal growth. For the arrest of hæmorrhage sucking ice may suffice, or spraying the larynx with a very weak adrenalin solution may be tried. For hæmorrhages due to purpura, renal disease, arterial sclerosis, etc., the treatment of the underlying dyscrasia is the best means of preventing their recurrence.

It is important to bear in mind that unless the bleeding point in the larynx can be seen the hæmorrhages may really be pulmonary in source.

P. WATSON-WILLIAMS.

INJURIES OF THE LARYNX.

FRACTURES.

These are usually due to compression, as in throttling, sometimes to a direct blow or fall. The thyroid cartilage is most often broken, the fracture being usually longitudinal, but, in cases of direct violence, sometimes stellate. Fracture of the cricoid cartilage is less common and more dangerous. The most important symptom is dyspnœa, either immediate from displacement, or later owing to œdema. Other results are pain on swallowing and speaking, hoarseness or aphonia, emphysema and hæmorrhage into the air-passages. There is often severe shock.

If there is the least sign of obstruction to respiration, tracheotomy should be performed. If there is displacement, the incision should be extended upwards and the fragments exposed and sutured in position; but this part of the operation must be postponed when there is much shock. If œdema of the larynx supervenes, the application of cold externally by means of an ice-bag or the use of leeches is indicated. If there is no sign of any obstruction, tracheotomy may be dispensed with; but it must be remembered that œdema may come on with great rapidity, and it is, therefore, safer to perform tracheotomy if there is any doubt, or if the surgeon cannot remain within reach. Insufflations of orthoform (gr. 3 to 5) are useful for the dysphagia, and an unirritating semisolid diet must be ordered. Complete rest is essential and talking must be forbidden. Cicatricial stenosis may follow and prove very intractable.

WOUNDS.

These come under the category of "cut-throat," and are generally suicidal. When made in the thyro-hyoid space, the epiglottis, partly severed, may cause asphyxiation by hanging over the laryngeal aperture. The thyroid cartilage is not often cut through, but the larynx may be opened below the cords through the crico-thyroid membrane.

Next to the dangers of shock and hæmorrhage, the most pressing risk is from the entrance of blood into the air-passages. Small penetrating wounds may cause very extensive emphysema. Later dangers are sepsis and pneumonia and local inflammatory changes which produce stenosis.

The first thing to do is to arrest the hæmorrhage. If blood is entering the windpipe and cannot be immediately controlled, tracheotomy must be performed at once, and the trachea above the cannula packed with gauze. The ends of the gauze strips must be secured to prevent them from being sucked down the trachea. If there is profound shock, it is wiser to do nothing more at first except to clip any vessels and to dress the wound. Later, or at once if the patient's strength allows, the divided structures should be carefully approximated, catgut being preferable for the buried sutures as the wound is not aseptic. If the hæmorrhage is readily controlled, and no blood is entering the air-passages, the question arises as to whether tracheotomy should be performed or not. This may not be necessary when the wound is clean and sharply incised; but the bleeding may recur, œdema of the larynx may supervene very rapidly, or discharges may reach the lungs if the wound becomes septic, as it probably will. It is, therefore, probably wiser to perform tracheotomy, and to plug the air-way above the cannula with gauze in all penetrating wounds of the larynx. During healing the head should be kept well flexed to approximate the parts. These wounds usually become extremely septic, and the dressings must be very frequently changed. It is well to use a loose many-tailed bandage, and a light wet dressing which is changed every hour. The tracheal packing must be changed twice a day. Careful and frequent cleansing of the mouth is also essential. When the pharynx and œsophagus are uninjured there is no object in withholding food by the mouth, but it is well first to give a few spoonfuls of sterilised water to make sure that deglutition can be properly performed. Cicatricial stenosis of the larynx is very liable to result.

HAROLD BARWELL.

LARYNGEAL SPASM IN CHILDREN.

LARYNGISMUS STRIDULUS.

Laryngospasm, or Laryngismus Stridulus, the spasmodic closure of the glottis caused by spasm of the adductor muscles of the larynx, is a purely nervous phenomenon. The typical crow is due to inspiration through a narrow glottis and is preceded by a period of apnœa. Hence arise the names "child crowing" and "holding breath spasms." Like tetany, it is most frequent at six to eighteen months of age, and is often associated with rickets and the signs of *spasmophilia*. Hyper-excitability of the nervous system and rickets are the chief predisposing causes, while the main excitants are reflex irritation, alimentary or pharyngeal. Adenoids or post-nasal catarrh grafted on adenoid hyperplasia may set up laryngospasm in the first few weeks of life. A further factor is the stimulation of the respiratory centre by imperfectly aërated blood, for the attacks are most frequent at night in infants breathing impure air and during sleep, when respiration is at a low ebb.

Mild attacks require no immediate treatment, for their duration is momentary. In severe ones the child must be raised into the sitting posture or be carried about in the nurse's arms, and not allowed to lie down. The room should be fully ventilated and no crowding about the patient permitted.

The quickest way to relieve the spasm is hooking forward the epiglottis with the finger, a method imperatively needed if this structure is impacted. Other methods available are the application to the throat of a sponge or flannel wrung out in hot water; slapping the face or chest with the end of a towel dipped in cold water; pouring cold water on a child's head while he is in a hot bath; the application of ice to the larynx or epigastrium; stimulation of the conjunctiva with the tip of the finger, or of the nasal mucosa by means of a feather; the induction of vomiting by tickling the fauces with a feather or the finger; inhalations of chloroform, ether, amyl-nitrite, smelling salts or acetic acid. Artificial respiration is necessary for sudden pallor, dilatation of the pupils, and the cessation of struggling and breathing. In bad cases the attendant should be taught how to conduct this method of treatment. Attacks can be prevented by isolating the child and protecting him from all causes of excitement and agitation, from laughter and emotion, from draughts of cold air while asleep, and from being suddenly startled.

To prevent recurrence a nightly dose of sodium bromide (4 to 10 gr.) should be given, or of phenazone, (1 to 4 gr.), to which may be added codeia ($\frac{1}{32}$ to $\frac{1}{16}$ gr.) and syr. aurantii (1 drachm). Should the attacks occur during the daytime bromide should be given every four hours; or a mixture of phenazone, 8 gr.; codeia, $\frac{1}{2}$ gr.; syr. aurantii, 2 oz.; one drachm every one or two hours. Such doses are suitable at one year of age. If these remedies fail chloral (1 to 4 gr.) may be tried, alone or with bromide, at night or every six hours; or chloral (5 to 10 gr.) by rectum every six hours. The liquid extract of grindelia (10 to 20 min.) four-hourly, has also been recommended. Morphine *sub cutem* is most efficacious, the dose being $\frac{1}{1000}$ gr. per lb. of body weight; or $\frac{1}{200}$ gr. per lb., if given by mouth, in the twenty-four hours in divided doses.

A plentiful supply of air by day and night is essential. The nurseries should be at the top of the house. The diet must be regulated, over-feeding and distension of the stomach being avoided, gastro-intestinal irritation prevented, and the bowels kept open regularly. A grey powder or a dose of pulv. rhei co. should be given at the outset, and a mixture of rhubarb and soda if the state of the alimentary tract is unsatisfactory. In addition, the rachitic condition and any local sources of irritation, notably adenoids, post-nasal catarrh, or an elongated uvula, must receive attention.

LARYNGITIS STRIDULOSA.

Laryngitis Stridulosa is a catarrhal laryngitis *plus* the spasmodic element seen in laryngospasm. The exciting cause of the spasm is within the larynx; and between the spasmodic attacks there is evidence of laryngeal trouble in the hoarseness, cough and fever. During the spasm there is inspiratory stridor, recession of the lower ribs and epigastrium, and progressive asphyxia. The stridulous breathing lasts longer than in laryngospasm and there is rarely complete apnœa. Attacks usually come on at night after premonitory slight signs of catarrh. Catarrhal laryngitis occurs at any age but is comparatively infrequent after the fourth year of life. Rickets and adenoids are the chief predisposing factors. Consequently the treatment of laryngitis stridulosa is the same as that of laryngeal catarrh, combined with measures to combat the spasmodic tendency. Even the mildest attacks of catarrh must be carefully treated and the patient watched, because of the risk that spasm or œdema may rapidly develop or the attack become a severe one. Children under years old must be kept in bed in a warm, well ventilated room. lder children bed is not essential in mild cases without fever. ht diet and an initial calomel or saline purge will be sufficient. tent or half tent and a bronchitis kettle, with eucalyptus, ure benzoin co., creosote, terebene, or turpentine should be oyed. Older patients can inhale these drugs from an inhaler a large face piece, the water in the vessel being at 100° 0° F. Oxygen inhalations are beneficial for cyanosis.

ght hot compresses or a mustard leaf should be applied fretly to the throat. In severe cases and in the acute œdema due alds cold compresses or an ice-bag may be more efficacious.

diaphoretic and diuretic mixture may be prescribed. If the and bowels act freely the symptoms are usually relieved. Pretions of ipecacuanha and antimony are often given in small ient doses, but in my experience they have little real influence ie catarrh and are liable to upset the stomach. If there is the suspicion that the laryngeal mischief is diphtheritic in origin, se of antitoxin should be given.

the treatment of catarrhal laryngitis on these lines the liability asm of the glottis is reduced. Yet it may occur in the mildest , usually during the night. Measures must then be adopted he relief of the spasm. It is often allayed by vomiting, which e induced by giving vin. ipecac. (1 drachm) [U.S.P. $\frac{1}{2}$ drachm] lv. ipecac. (5 gr.) half hourly until emesis is induced. Whitla nmends vin. ipecac., vin. antimon., syr. scillæ (āā 10 min.) m, ad ʒss [U.S.P. vin. ipecac., ♏6; vin. antimon., syr. scillæ, āā ; aquam, ad ʒss] every fifteen minutes for a baby one year old. tics should only be given to strong robust children, and even there is little to be said in their favour. Simpler methods opping the spasm are hot applications to the throat, inhala- of steam, a hot or mustard bath, and inhalations of chloro- or amyl-nitrite. A dose of chloral, bromide or phenazone be given at bedtime as a preventive. Other measures mmended for the prevention of laryngospasm are suitable when atarrh has subsided.

ordinary cases fomentations and inhalations must be continued the child is convalescent. Afterwards attention is directed e general health. The susceptibility to catarrh may be reduced esh air, cold bathing and daily sponging the neck with cold r. The child should be protected from chills, damp bed and armed rooms. Adenoids and enlarged tonsils should be removed, esent; and the rachitic element treated. Arsenic, iron and iver oil are the best drugs.

In severe cases of laryngeal catarrh the question of operation will arise. Should energetic treatment have been efficiently carried out and yet at the end of an hour the signs of grave obstruction persist and show no signs of yielding but are rather getting worse, recourse must be had to intubation or tracheotomy. Laryngeal spasm may occur quite suddenly and end fatally in a few minutes. Hence operation is more urgently needed in private cases than in hospital practice, where immediate help is available. The signs of increasing severity are rising temperature, more frequent pulse and respiration rate, greater stridor and recession, increasing restlessness, lividity, pallor and prostration. If there is no diphtheritic infection operative measures should be postponed as long as possible. Intubation can be done earlier than tracheotomy, for the risks incident to the tracheotomy wound are avoided. Tracheotomy is preferable, unless the operator is expert in intubating, but it must be avoided, if possible, in girls, who may have to wear low-necked dresses in later life. In all cases of laryngeal spasm dependent on inflammatory affections of the larynx the treatment is essentially that of the underlying cause, and the adoption of measures for the immediate relief of spasm and the prevention of its recurrence.

EDMUND CAUTLEY.

LARYNGITIS.

ACUTE LARYNGITIS.

Confronted with a patient presumably suffering from acute or sub-acute laryngitis, it is well to ask one's self two questions, viz.: (1) Is the case merely simulating laryngitis? For instance, pressure on a vagus nerve trunk by an intrathoracic aneurism may cause an irritating cough, while the paresis resulting from pressure in the efferent or motor fibres to the vocal cords may at the same time cause sufficient paresis of the muscles to produce hoarseness. (2) Is the laryngitis secondary to some zymotic or other infective complaint? Thus, measles is generally ushered in by rhinitis and laryngitis, so easily mistaken for a common cold with laryngo-bronchitis, when other precautions, besides the relief of the laryngeal symptoms, obviously become desirable. Again, it is well to remember that recurrent attacks of laryngitis often precede the development of laryngeal or pulmonary tuberculosis, and the possibility of commencing tuberculous disease being the real cause of the laryngeal manifestations should never be lost sight of.

In adults the symptoms of simple acute laryngitis are purely local, for, although the usually associated tracheitis and bronchitis may cause considerable dyspnœa and general disturbance, the glottic aperture is large enough to ensure that the relatively slight swelling of the mucosa will not be attended with laryngeal stenosis. Hence if symptoms of persistent laryngeal obstruction arise, we have to deal with something else than acutè laryngitis, for even the transient but troublesome spasms, which sometimes attend the early stages of laryngitis, more particularly when occurring in gouty subjects, only cause dyspnœa for a few seconds at most.

In children the symptoms of acute laryngitis are generally of a severer type, for, firstly, the lymphatic supply to the mucous membranes in children is more extensive than in adults, as shown by Sappey, hence any inflammatory invasion is attended with greater degrees of infiltration; secondly, the glottic aperture in children is not only actually much smaller than in later life, but it is relatively smaller, so that even slight degrees of inflammatory swelling in the region of the glottis is prone to cause definite restriction of the breathing space; and, thirdly, their nerve centres respond more quickly to disturbing influences whether they be such as lead to febrile reaction, to reflex spasms or to paresis of the musculature of the involved territory. Hence laryngitis, even in its slighter forms when occurring in young children, should never be regarded as trivial and unworthy of serious attention; while the severer attacks of even simple laryngitis of early childhood in the course of a few hours, may pass into the severer form of croup attended with laryngeal spasms with liability to pulmonary complications. (For treatment of spasmodic laryngitis in children, *see* p. 827.)

Treatment.—In all cases of acute laryngitis absolute rest of the voice is essential, and the less the patient uses even a whispering voice the sooner will the parts recover their functional activity. It is the more necessary to emphasise this where by means of sedatives the patient is freed from pain and acute discomfort in talking, for in all but the milder attacks the intrinsic muscles of the larynx are inflamed and infiltrated, and the myositis makes speech an additional effort at a time when the muscles are least fit for functional activity, whether the weakness of the internal tensors of the cords be due to implication of the nerve endings, as affirmed by Gerhardt, or to simple infiltration. For professional voice users it is obviously more important to ensure vocal rest than for others, and, when the voice does return, to enjoin no undue use of the voice until the weakened muscles have recovered their lost tone, otherwise prolonged or even permanent vocal impairment may ensue.

Hardly less important are reasonable measures to lessen the frequent and irritating cough, since it is useless to avoid speech and strain the vocal muscles with constant coughing. Hence vocal rest, confinement to a warm room or to bed, free evacuation of the bowels, abstinence from smoking, and very moderate use of alcohol, are all important. A cold compress applied externally over the larynx for several hours continuously, changing the compress every hour or two, is often comforting.

Counter-irritation may be employed in the form of a poultice of mustard and linseed, or a mustard leaf. The poultice should be placed right across the larynx so as to reach halfway round the neck, but a mustard leaf should be placed over the episternum and the upper part of the manubrium so that the counter-irritation is applied mainly to the so-called laryngo-tracheal spot. The poultice should be kept on for about an hour, but of course about ten minutes is long enough for the more irritating mustard leaf.

Sucking ice is often commended and is sometimes comforting, but I have usually found warmth better than cold, particularly steam inhalations containing compound tincture of benzoin (with or without a few drops of chloroform) or creosote, *e.g.*, Compound Tincture of Benzoin, 1 fluid drachm, to a pint of hot water (140° F.), for each inhalation. Compound Tincture of Benzoin, 1 fluid drachm, with Chloroform, ♏2 or ♏3, mix and add to a pint of hot water (about 140° F.). Tincture of Hyoscyamus, ʒj, or Tincture of Belladonna, ʒj, to 1 pint of hot water, and the steam inhaled. Creosote, ♏80; Light Magnesium Carbonate, gr. 30; Distilled Water to 1 fluid ounce; a teaspoonful to be added to a pint of hot water for each inhalation.

Such inhalations may be followed or replaced by an atomiser, and either a laryngeal atomiser or a nasal atomiser may be used; with the latter the atomiser is placed just inside or close to the mouth, and quick inspirations made several times so as to draw the atomiser fluid down the trachea.

Examples of sedative solutions for the atomiser are: (a) Menthol, gr. 4; Eucalyptol, ♏8; Terebene, ♏10; Cocaine, gr. 4; Colourless Oil of Paraffin to ℥ ss. (b) Solution of Suprarenal Extract, ♏10; Cocaine Hydrochloride, gr. 10; Glycerine, ♏10; Distilled or Rose Water to ℥ ss, for use with a very fine water atomiser or laryngeal spray.

Internally ipecacuanha in a diaphoretic mixture is often helpful: ℞. Vin. Ipecacuanhæ, ♏5 to 10; Antimon. Tart., gr. $\frac{1}{100}$ to $\frac{1}{40}$; Spir. Æther. Nitros., ♏20; Syr. Scill., ʒj; Aq. Chloroformi, ad ℥j [U.S.P., ℞. Vin. Ipecacuanhæ, ♏3 to 6; Antimon. et Potass. Tart., gr. $\frac{1}{100}$ to $\frac{1}{40}$; Spir. Æther. Nitros., ♏20; Syr. Scillæ, ʒj; Aq. Chloroformi, ℥ ss.; Aquam, ad ℥j]; every three or four hours.

If the patient is gouty nothing relieves the laryngeal symptoms so quickly as colchicum, *e.g.*: ℞. Vin. Colchici, ♏10; Aspirin, gr. 15; Aq. Chlorof., ad ℥j, three times daily; or 20 min. of colchicum wine and 20 gr. of salicylate of sodium may be given in 10 fluid ounces of Vichy water (Celestin) twice daily between meals.

In children the most valuable remedy is ipecacuanha, and the prompt administration of an emetic dose will often prevent an attack of spasmodic croup. It is usually better in such patients to give large doses and cause vomiting than to employ small and less effectual doses. Antimonial emetics are preferred by some, but they are more depressing. The value of emesis lies not so much in the emptying of the stomach as in the fact that ipecacuanha seems to cause bronchiolar contractions, in other words the bronchi are made to vomit, the emptying of the stomach is concomitant and unavoidable. I prefer to employ de-cephælinised ipecacuanha, in the form of liquor ipecacuanhæ albæ (Matthews), as it is less depressing, and less likely to nauseate, while, given in the same dose, it seems equally effectual in influencing the laryngo-bronchial mucosa as ipecacuanha. If the child is feverish, minute and frequently repeated doses of aconite are useful, *e.g.*, tincture aconiti, $\frac{1}{2}$ min. [U.S.P., $\frac{1}{4}$ min.] in water every one or two hours. When there is troublesome laryngeal spasm $\frac{1}{500}$ to $\frac{1}{250}$ gr. of trinitrin, or caffein citrate and bromide of potassium or ammonium, may be given with advantage every four hours or so.

One is sometimes called upon to enable a professional singer or public speaker to carry out an engagement of importance while suffering from laryngitis, although they may run considerable risk at least of prolonged vocal impairment as a consequence. In such circumstances the bowels should be freely evacuated and a mustard poultice applied externally for ten to fifteen minutes. I have found much help from pastiles containing morphine, $\frac{1}{12}$ gr.; cubebs, 1 gr.; atropine sulphate, $\frac{1}{120}$ gr.; proto-iodide of mercury, $\frac{1}{60}$ gr.; one sucked every four hours till not more than six have been taken. A hypodermic injection of strychnine $\frac{1}{60}$ to $\frac{1}{30}$ gr. should be given shortly before the engagement. Immediately before singing or making the speech the patient should use a fine aqueous atomiser, containing the following solution: ℞. Liquor. Atropin., ♏1; Adrenalin. Chlor., ♏8; Cocain. Hydrochl., gr. 8; Glycerin., ♏8; Aq. Destil., ℥ ss. [U.S.P., ℞. Atropin. Sulph., gr. $\frac{1}{110}$; Adrenalin. Chlor., ♏8; Cocain. Hydrochlor., gr. 8; Glycerin. ♏8; Aq. Destil., ℥ ss.]; or an oil atomiser containing Morphine, gr. ss.; Menthol, gr. 8; Cocaine, gr. 4; Colourless Oil of Vaseline to ℥ ss.

After-treatment is important, but as it is practically the same as for chronic laryngitis, it will be discussed in that section; suffice it to say that care against exposure to cold, warm clothing and the avoidance of those conditions which tend to cause the affection, are obviously necessary precautions against recurrence.

CHRONIC LARYNGITIS.

As the successful treatment of chronic laryngitis frequently depends on the recognition of the underlying pathogenetic factors, it will be useful to enumerate the chief causes, but before doing so I would again emphasise the importance of excluding various affections which give rise to symptoms so closely simulating chronic laryngitis as to be often indistinguishable without a careful laryngoscopic inspection.

Chronic laryngitis very frequently supervenes on acute or sub-acute laryngitis, hence all causes of acute laryngitis are also causes of the chronic form. Other cases develop gradually from excessive or faulty use of the voice, working in dusty atmospheres, or they may be due to chronic dyspepsia, rheumatism, gout, or abuse of alcohol or tobacco.

Not the least important is the large class of cases due to nasal affections; nasal obstruction alone may cause hoarseness from the resulting mouth breathing. Much more frequently laryngitis associated with pharyngitis is due to septic infection from organisms in the muco-purulent secretion from one or more of the nasal accessory sinuses, either the maxillary antra, posterior ethmoidal cells or sphenoidal sinuses. If a sinus infection is sufficiently virulent to cause marked swelling of the mucosa or occlusion of the ostium, the patient usually complains of severe headache and of other symptoms referable to the nose, but often enough the infection is a milder character sufficient to cause muco-purulent or, perhaps, almost clear secretion which, constantly passing down the back of the throat, only causes symptoms of chronic pharyngitis.

Again, the laryngeal affection may be due not to nasal obstruction but to undue patency of the nasal passages, as in ozœna, when the abnormal dryness of the air inspired through the nose, leading to drying of the nasal mucosa, or the affection of the nasal mucosa, may spread to the pharynx and larynx, causing strings of sticky secretion to collect in the larynx itself.

In children the commonest nasal cause of laryngitis is the presence of adenoid growths.

Obviously the treatment of laryngitis in all the conditions just enumerated must be directed to the removal of the *fons et origo mali* rather than treatment of the larynx itself.

Equally important with the recognition and removal of nasal affections causing laryngitis is the treatment of any constitutional conditions that may act as predisposing causes of chronic laryngitis, *e.g.*, gout, rheumatism, dyspepsia, anæmia and constipation, also where such adverse causes obtain, the excessive use of alcohol or tobacco. Moreover, attention should be directed to the habits, occupation and environment of the patient. The sedentary occupation may require to be counteracted by regular exercise, the life indoors in overheated or close atmosphere by plenty of fresh air, while exposure to irritating vapours or dust may require giving up the usual occupation.

Schoolmasters and mistresses sometimes suffer from the constant inhalation of chalk dust from a blackboard. But in all professional voice users the possibility of wrong vocal methods should be remembered as causes of laryngitis.

In addition to the general hygienic precautions already suggested, the importance of attending to the general condition of health is to be commended, and such remedies as strychnine, phosphorus, iron and quinine are often of great value. Obstinate cases will sometimes improve by a change of air or a sea voyage. For others a course of waters at Ems, Carlsbad, Aix-les-Bains, Wildbad, etc., may be recommended. I have found Ems water of much value in gouty cases; three-fourths of a tumbler of Emser Kränchen, to which one-fourth of boiling milk has been added, should be sipped slowly on rising every morning.

Especially when there is much secretion stimulating inhalations may be ordered every night, *e.g.*, Oil of Scotch Pine or of Pinus Pumilio, ♏40; Light Magnesium carbonate, gr. 20; Water to 1 fluid ounce. For patients in whom the affection tends to become inveterate or does not yield to milder measures, and particularly in cases where there are hypertrophic changes, local applications by means of a laryngeal swab or brush are indicated, *e.g.*, zinc chloride (10 to 20 gr. to the fluid ounce); perchloride of iron (2 to 20 gr. to the fluid ounce); nitrate of silver (5 to 30 gr. to the fluid ounce).

Such pigments should be applied with the help of a laryngoscopic inspection. The brush or swab should be charged with the fluid so as to make it thoroughly wet and yet not so wet as to risk the dropping of the fluid into the trachea when the application is made. The patient should protrude his tongue, and hold it by means of a tongue cloth in his right hand, while the physician gets a laryngoscopic view, holding the laryngoscope in his left hand, and then makes the application with the swab in his right hand. Another way, and one more comfortable for the patient, is to make the application by means of a fine laryngeal spray that can be turned on when in position and at once stopped as soon as the required amount has been injected. It will be obvious that if the brush, swab or spray is to get to the glottis instead of going down to the œsophagus behind the larynx, the handle must be tilted up so as to direct the distal end downwards and slightly forwards behind the base of the tongue.

Lozenges or pastils may be given; for the gouty, cubebs and guaiacum are particularly useful, but terpene and Scotch pine are also to be commended.

A child with symptoms of chronic laryngitis may have a laryngeal papilloma, or congenital syphilis with gummatous deposit or ulceration, or a commencing tuberculous laryngitis, and the absence of pain or febrile disturbance in the two former affections may easily mislead.

In young adults recurrent tuberculous laryngitis is most likely to be mistaken for simple chronic laryngitis, and in middle life paresis of a vocal cord due to aneurysm or the pressure of a gland or tumour on a recurrent laryngeal nerve.

In later life the possibility of hoarseness being due to cancer, involving a vocal cord or interfering with the closure of the cords on phonation, should never be forgotten, for hoarseness without pain or other symptoms is the commonest symptom of early intrinsic malignant deposits in the larynx, and I have known cases where most valuable time has been lost from the mistaken idea that the hoarseness was due to laryngitis.

P. WATSON-WILLIAMS.

LUPUS OF THE LARYNX.

The disease attacks first the edge of the epiglottis, and spreads slowly into the lumen of the larynx; it is characterised by absence of pain, by extreme chronicity and by a tendency to the formation of dense scar-tissue, which, in bad cases, produces severe stenosis. The only important symptom in the early stages is hoarseness, which is followed by dyspnœa if stenosis ensues.

General Treatment.—The disease tends to improve markedly under general constitutional treatment, and the typical scarred, nibbled edge of the epiglottis characteristic of healed lupus is sometimes seen in patients who have had no local treatment, and who may even be unaware that the larynx has ever been affected. A full open-air *régime* with ample feeding should be enjoined; indeed, a stay at a sanatorium at the outset has both a curative and an educational value. Cod-liver oil is useful. Arsenic may be considered almost a specific; it should be given in full doses (♏5 of liquor arsenicalis [U.S.P. liquor potassii arsenitis] three times a day, increased by 1 minim daily until 15 minims is reached). If toxic symptoms supervene it should be omitted for a week, but its use can usually be resumed at the same dose at which it was stopped. The effect of tuberculin is uncertain, but it sometimes appears to do good, and its administration in this local affection is not attended by the drawbacks to its use in tuberculous laryngitis. The dose given should be insufficient to cause marked local reaction, $\frac{1}{10,000}$ milligramme of the tuberculin R being large enough for the initial injection; further doses should only be repeated when any reaction has completely subsided (*see* Tuberculin Therapy).

Local treatment, except the palliative use of an oily spray (such as menthol, gr. 10; paraffinum liquidum, ad ℥j), may be withheld with advantage as long as the condition is improving rapidly under these general measures, but should be adopted when improvement halts. Applications of lactic acid (50 to 100 per cent. of the pharmacopœial drug), or a mixture containing lactic acid (50 per cent.), formalin (7 per cent.), and phenol (10 per cent.) may be made once or twice weekly. They should be applied on a cotton-wool applicator under guidance with the mirror and firmly rubbed into the affected parts. The galvano-cautery is of great use in the treatment of laryngeal lupus; deep puncture should be employed on the upper aperture and ventricular bands, but superficial applications only should be made to the vocal cords. This method must be employed with discretion and care taken to avoid cauterisation of healthy tissues, lest the natural tendency to stenosis be increased.

HAROLD BARWELL.

NEUROSES OF THE LARYNX.

MOTOR NEUROSES.

Motor Neuroses of the larynx fall naturally into two main divisions, the spasmodic affections and those associated with paresis or paralysis of the intrinsic laryngeal muscles, though occasionally spasm and paresis co-exist. But, while spasm is always due to central irritation, paralytic phenomena may be due to bulbar lesions or to involvement of any portion of the recurrent nerve fibres, or to a myopathy apart from any nerve lesion. Thus, so manifold are the causes of laryngeal neurosis that it is impossible to enter upon the treatment of a given case without a careful inquiry as to the particular cause producing the lesion.

SPASMODIC AFFECTIONS.

Spasm of the laryngeal muscle may be due to lesions of the nerve centres, the nerve trunks, or of single nerve twigs. The various spasmodic affections may be divided into three groups: (1) Respiratory spasm; (2) phonatory spasm; (3) neuroses of co-ordination.

Respiratory Glottic Spasm (Laryngismus Stridulus).—(*See* Laryngeal Spasm in Children, p. 826.)

Laryngeal Spasm in Adults is generally due either to irritation of a vagus trunk by an aneurysm or tumour. Occasionally it appears to be a reflex irritation from an hypertrophied lingual tonsil or uvula, or it occurs in the course of certain diseases involving the nerve centres, *e.g.*, whooping cough (when there may be no whoop), tetany, hydrophobia, or in the laryngeal crises of tabes dorsalis.

But simpler causes are sometimes provocative of laryngeal spasms which may be very distressing, *e.g.*, gouty conditions and dyspepsia. I have known a case where suffocative attacks of spasm which came on suddenly in sleep due to dyspepsia in a gouty patient were cured when the gouty habit and dyspepsia were overcome.

The treatment is largely a question of diagnosis, for it is obviously useless to treat cases of aneurysm of the thoracic aorta and gouty dyspepsia in the same way, and once the diagnosis is made the general treatment called for is plain. I have directed attention to the possibility of whooping cough being the cause of spasm because

I have seen several cases in adults where laryngeal spasm has been the only symptom, but in which there was no room for doubt that they were cases of whooping cough occurring in adults who had had the affection in childhood, but had been exposed to infection in later life.

Nervous Laryngeal Cough is an affection of puberty and early adolescence, generally known as "the barking cough of puberty," and characterised by a single loud bark or rough cough due to a spasmodic closure of the glottis in association with a spasmodic cough, during which the adductors are forcibly contracted. It may last for weeks or months. The exhibition of iron in considerable doses, and of aperients where constipation exists, seems to influence the affection favourably and will often cause the cough to disappear.

Phonetic Spasm (Dysphonia Spastica) is a form of glottic spasm which only occurs in attempting to speak, and is almost confined to professional or public speakers. The only treatment that offers hope of relief is lessons in elocution, for in most cases vocal methods are at fault.

Laryngeal Vertigo or Ictus Laryngea.—In this peculiar affection the patient, while seemingly in a condition of perfect health or at most only suffering from a slight catarrh of the upper respiratory tract complains of a tickling sensation with giddiness and obscurity of vision, followed by sudden loss of consciousness lasting a few seconds only. The face is sometimes pale, sometimes cyanosed, and sometimes the attack is accompanied by facial twitchings and slight convulsions in the limbs. The treatment consists in avoiding everything that is known to produce the attacks, and in doing everything to improve the general health and tone.

Ataxia of the Vocal Cords.—In certain diseases, *e.g.*, chorea and disseminated sclerosis, choreic movements and tremor of the vocal cords have been observed. No treatment of the larynx is called for.

Stammering, Stuttering (*see* pp. 327, 331).

PARESIS OR PARALYSIS OF THE INTRINSIC LARYNGEAL MUSCLES.

Motor paralysis or paresis of the vocal cords may be due to lesions in any portion of the motor nerve tract from the cortex to the termination of the motor nerve fibres in the superior laryngeal and recurrent laryngeal nerves. But it will be convenient to include here the paresis due to myopathies of the intrinsic laryngeal muscles.

1. Paralysis of the Abductor Muscles.—Abductor paresis or paralysis may be due to pressure on one or both recurrent laryngeal nerves, *e.g.*, by an aneurysm, a tumour in the neck, or in the walls of the œsophagus, enlarged glands, or on the right side only, by a pleural thickening or pneumonia involving the right upper lobe. It may also be due to central nerve lesions involving the medulla, such as tabes, or disseminated sclerosis, bulbar paralysis or general paralysis of the insane, or to cerebral syphilis, tumours of the brain or pachymeningitis.

The affection of the vocal cords in all these conditions are of course only matters of diagnostic value but do not call for treatment.

But abductor paralysis may be due to toxic peripheral neuritis in the course of pneumonia, influenza, rheumatism, diphtheria and typhoid fever, or furthermore it may be myopathic in origin. In such conditions, apart from the general treatment called for, the restoration of the involved abductors may be aided by strychnine internally and by gentle local faradisation of the vocal cords, using in these cases mild currents in contradistinction to the strong faradic currents employed in hysterical cases.

2. Paralysis of the Adductor Muscles.—Paralysis of these muscles is almost always *bilateral* and due (*a*) to functional disorders of the cortex, *e.g.*, the somewhat common so-called *hysterical aphonia*, in which paresis only is present and is only observed in volitional speech; (*b*) the rare cases which appear to be reflex in character and attributable to uterine causes.

The onset of the paresis is sudden and often the disappearance of the trouble is equally sudden. But sometimes the recovery of voice is gradual and even if suddenly restored the paralysis is always liable to recur.

When limited to one vocal cord, adductor paresis or paralysis (apart from abductor implication) is always due to local causes involving the terminal nerve twigs or muscles. It is a very rare occurrence as a sequence of cold, syphilis, etc.

The treatment of *hysterical aphonia* is usually easy and brilliant in result, but often enough the affection is refractory and sometimes it defies all therapeutic efforts. The mere insertion of the laryngoscopic mirror into the usual position on the soft palate may call forth speech, or the insertion of the mirror, or of a laryngeal brush or swab into the larynx, together with a sharp command to say "Ah!" or "Oh!" If these simple procedures are not at once successful, one ought to stimulate the vocal cord muscles by intra-laryngeal faradisation. To carry out this procedure attach one wire of a faradic battery to a washleather covered metallic electrode, moistened with a weak solution of common salt, placed over the middle of the neck in front, the other pole being attached to an intra-laryngeal electrode, so arranged that while the battery is working the current can at once be turned on or off by pressing a small switch. Sit facing the patient, who should hold out the tongue as far as possible by grasping it with a tongue cloth with his right forefinger and thumb. With the left hand the physician inserts a laryngoscopic mirror and with a good light inspects the larynx and vocal cords, then rapidly inserting the laryngeal electrode (held in his right hand) the current is switched on as soon as the electrode passes down between the vocal cords. At the same time the patient may be commanded to say "Ah!" but this is rarely necessary, because the current, if strong enough, startles or perhaps pains the patient into an involuntary exclamation. Withdrawing the electrode, at once urge the patient to say "Ah!" "Oh!" "Ah!" and encourage her doing so in a loud voice till the patient's confidence in her power of speech is restored. A second application may be necessary, sharper than the first, but it is a standing rule always to use as strong a current as the patient can reasonably bear at the onset, so as, if possible, to get the pronounced effect immediately. Afterwards a weak voice can sometimes be made strong by passing the current through from one side of the thyroid cartilage to the other.

General treatment is also called for, such remedies as iron, strychnine, arsenic, valerianate of zinc and so forth being especially useful, while fresh air, cold bathing, massage and all general hygienic measures have often to be employed before a cure can be permanently effected.

Some methods recommended for cases of hysterical or purely functional aphonia, where there is no inflammatory affection of the larynx itself, must be employed with considerable caution.

When the aphonia is due to any pathological condition within the larynx itself, such as muscular weakness following a cold, syphilitic, diphtheritic or other causes of laryngitis, naturally any syphilitic or diphtheritic taint calls for special treatment. Above all is it important not to mistake an early tuberculous laryngitis or myositis for hysterical aphonia. Slow development of vocal weakness preceding the onset of complete aphonia, particularly when associated with any redness and swelling of the vocal cords or of the parts in the region of the glottic aperture, would point to causes, other than mere hysteria, as the real source of the aphonia.

3. Paralysis of the Thyro-arytenoidei Interni or Internal Tensors of the Vocal Cords.—It has been pointed out that paresis of these small muscles frequently arises in sequence to paralysis of the abductors, but the only cases calling for special note here are those in which the thyro-arytenoidei alone are involved. This not very rarely happens after any severe laryngitis, but is most frequently due to catarrhal laryngitis or over-straining of the voice.

Caution should be given against much use of the voice and avoidance of any vocal strain till the muscles have recovered their tone. The use of strychnine, other tonics and gentle intra-laryngeal faradisation are the most useful remedies as aids to the most important remedy of all—*rest*.

4. **Paralysis of the Inter-arytenoideus Muscle.** — This muscle acts by bringing together the arytenoids during cough and phonation, and acts in conjunction with the adductors of the vocal cords. When it is paralysed alone a triangular chink is left between the vocal processes on attempted phonation and the voice is generally weak or completely lost. The most usual causes are catarrhal laryngitis and hysteria. Local faradisation and general tonic and hygienic measures should be employed.

5. **Complete recurrent paralysis or complete paralysis of the vocal cords.**—Any of the diseases recited as causes of abductor paralysis may also produce complete recurrent paralysis, and it also, of course, follows section of a recurrent nerve either in attempted suicide, accident, or in the course of a surgical operation in the neck.

When the paralysis is due to inflammatory thickening in or around the crico-arytenoid joint it may be possible to overcome the difficulty by local treatment. The causes of such crico-arytenoid fixation may be gout or rheumatism involving the joint, measles, scarlatina, and diphtheria; but mechanical injury, perichondritis, cancer, syphilis and tuberculosis are the most frequent causes. The only cases that we can treat directly for the ankylosis are those where a former benign inflammation of the crico-arytenoid joint has become quiescent; then gentle intra-laryngeal faradisation may be tried in the hope of gradually overcoming the resistance to movement offered by the thickened sub-mucosa. As a rule, however, if the repeated efforts of the muscles do not spontaneously suffice to overcome the fixation, no obvious benefit will follow local treatment.

SENSORY NEUROSES OF THE LARYNX.

Anæsthesia of the laryngeal mucosa, partial or complete, may be due to peripheral neuritis of the superior laryngeal nerves, as in diphtheria, syphilis or injury to the nerve, or it may be due to hysteria or to central nerve lesions, *e.g.*, bulbar paralysis, tabes, general paralysis of the insane, apoplexy or epilepsy.

Treatment of the underlying condition is called for in syphilitic disease of the central nervous system, while locally faradisation or the use of the galvanic current is useful in diphtheritic cases and hysteria; one pole being applied on the anterior wall of the pyriform sinus. Strychnine and arsenic are valuable in some cases.

When the anæsthesia leads to difficulty in swallowing due to the escape of food into the glottis, special care in feeding is necessary, and sometimes one has to resort to the nasal or œsophageal tube or else to rely entirely on nutrient enemata.

Neuralgia and Hyperæsthesia.—Locally a menthol or weak cocaine spraying may relieve severe pain of a neuralgic character. Generally it is only by improving the general health that any permanent benefit can be obtained.

P. WATSON-WILLIAMS.

BENIGN GROWTHS OF THE LARYNX.
(INCLUDING PACHYDERMIA).

SMALL tumours which do not interfere with the movements of the cords, and which cause no symptoms, may well be left alone. It is wise, also, not to attempt removal of **angiomata** *per vias naturales*. If hæmorrhage occur from an angioma, the bleeding point should be touched with the galvano-cautery at dull red heat; if there is severe or repeated bleeding, thyrotomy and excision are called for; but care must be taken to make the incision wide of the tumour. **Cysts** occasionally occur on the epiglottis or ary-epiglottic folds, and are treated by making a large opening with the galvano-cautery or punch forceps; they will always recur after simple incision.

The large majority of benign growths, however, are found at the junction of the anterior and middle thirds of the glottis, *i.e.*, on the centre of the vocal cord, for the hinder third of the glottis is formed by the arytenoid cartilage. They occur variously in the form of **papillomata, fibromata, myxo-fibromata** and **"singer's nodules."** With the exception of very small nodules, the treatment is removal, and that by endolaryngeal methods, for thyrotomy is not a justifiable operation for this class of tumour.

ENDOLARYNGEAL OPERATIONS.

The indirect method of operating with the aid of the laryngoscopic mirror is still, in the writer's opinion, the best, for it causes far less discomfort to the patient and can be performed with safety and certainty by a skilled laryngologist in the great majority of cases.[1] The larynx is thoroughly anæsthetised with cocaine hydrochloride, which is still the most suitable drug for this purpose. A few drops of a 10 per cent. solution in 1 in 1,000 adrenalin is applied with a curved syringe guided by the mirror. The solution is allowed to fall drop by drop on to the epiglottis and base of the tongue, the patient being instructed not to swallow any of it. After a few minutes the throat begins to feel numb, and the application is repeated; the syringe is passed over the epiglottis and the cocaine allowed to trickle over its laryngeal surface and to drop on to the growth. It is well finally to apply a few drops of 20 per cent. cocaine solution. The tongue is then held out in a cloth by the patient, the surgeon introduces the laryngoscope mirror with the left hand, and removes the growth with a suitable instrument held in the right hand. It is important that the surgeon should have a clear view at the time of removal. If this is not obtained he must take the instrument out and try again; but he should never attempt to remove the growth blindly, and so run the risk of damaging the cord. If the throat is very irritable, and the patient nervous, it may be impossible to complete the operation at the first sitting. In such cases a week's course of saline aperients, combined with abstinence from alcohol and tobacco, will usually suffice to make the throat amenable. When the epiglottis is dependent, it can usually be retracted by the forceps sufficiently to afford a view. Lack's forceps with an obtuse-angled shank are often useful for these cases. If not, Escat's or Mount Bleyer's epiglottis tractor may be employed. The epiglottis tractor is shaped like a tongue-spatula with a downwardly curved continuation, and is introduced by an assistant, after the tongue has been protruded, into the glosso-epiglottic fossa, and lifts the epiglottis by drawing forward the base of the tongue. Horsford has introduced a modification of Kurz's forceps, by means of which a needle carrying a length of silk can be passed through the epiglottis. An artery-forceps attached to the loop of silk and allowed to hang out of the mouth is sufficient to retract the epiglottis, and dispenses with the necessity of an assistant.

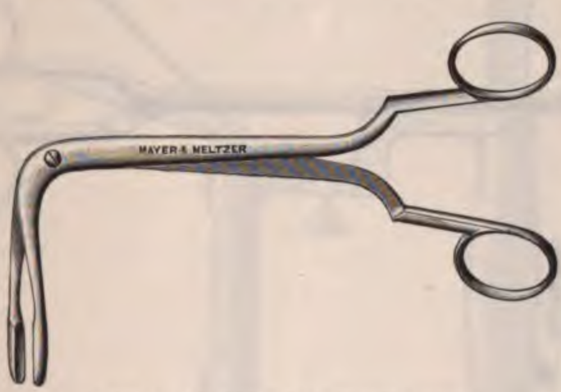

FIG. 1.—Mackenzie's Laryngeal Forceps.

The instrument employed for the removal of these growths is nearly always a forceps. Those with scissor-handles are generally used in this country, and Mackenzie's pattern is especially popular (Fig. 1). The forceps should have cup-shaped cutting edges.

Serrated or crushing forceps are now in disfavour, as they are apt to tear the mucous membrane from the cord. The distance from the dorsum of the tongue to the cords varies very considerably, and therefore forceps with different lengths from the bend should be at hand. An ante-flexed tip is sometimes needed for growths at the anterior commissure, and Lack's obtuse-angle pattern has been already mentioned as useful. Whistler's forceps (Fig. 2), the blades of which can be rotated into any position, is convenient for small tumours. A snare is sometimes employed for pedunculated growths which are too large to grasp in forceps. Unless it is certain that the pedicle is soft enough to cut through, the galvano-cautery snare only should be used, for it is a very awkward accident to surround with the snare a growth that can neither be cut nor pulled off.

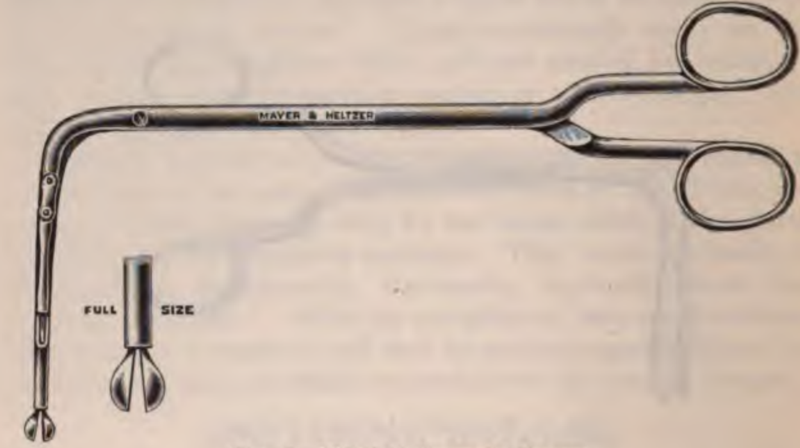

FIG. 2.—Whistler's Laryngeal Forceps.

The direct method of operating [2] is not recommended as the method of choice for the treatment of ordinary cases of benign laryngeal growths in adults, but is of great value in special cases; for instance, when the indirect method is rendered peculiarly difficult by a very pendulous epiglottis or voluminous tongue; for growths in the subglottic region; when general anæsthesia is required on account of extreme irritability and nervousness; and, above all, for the removal of papillomata in children. The principle of the method depends on the fact that the lumen of the larynx can be brought into a straight line with the mouth by fully extending the head and exercising forward traction on the soft parts about the hyoid and base of the tongue. The apparatus consists essentially of steel tubes of various sizes and shapes fixed to a handle, and the illumination is supplied either by a perforated mirror, which reflects the light from an electric lamp, or else by a tiny lamp fixed in the distal end of the tube. The instrument may be used under local or general anæsthesia, but the latter is necessary for children and nervous patients. Local anæsthesia must be very thorough, and is produced in the same way as for the indirect method. The patient sits on a low, straight chair and the surgeon stands above him; the head is thrown well back and is steadied

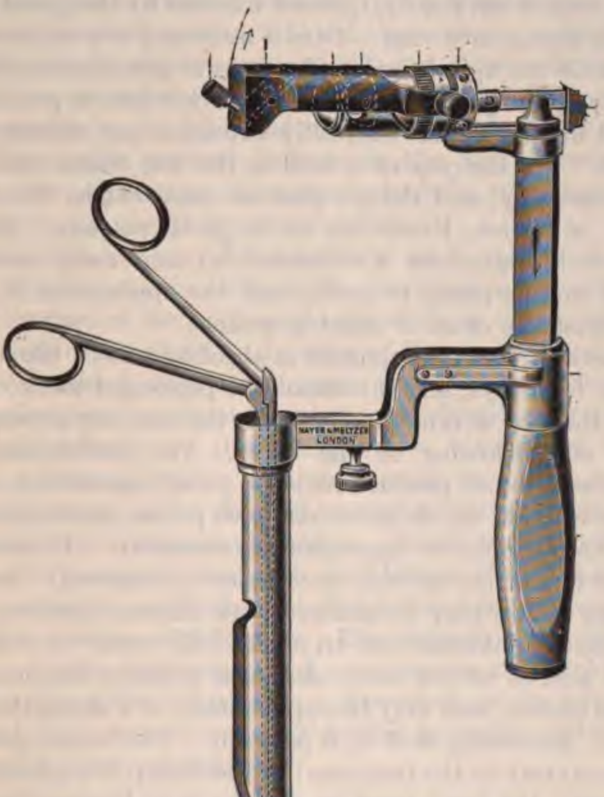

FIG. 3.—Brünings' Direct Laryngoscope, with Paterson's Forceps.

by an assistant. The patient is directed to open the mouth and breathe steadily, and the surgeon promises to remove the instrument at once should the patient give a pre-arranged signal. The tube is then introduced in the middle line ; the uvula is first seen, then the epiglottis ; the tube is passed downwards behind this for about ¾ inch, when steady, forward traction by the distal end will bring the larynx into view. Care is necessary not to exert pressure against the upper teeth. For general anæsthesia chloroform is essential ; the patient is placed in the left lateral position with the head in the middle line, fully extended and steadied by an assistant. The instrument is held in the left hand and passed in the same way, and the growths are removed by fine straight forceps, of which Paterson's is a good pattern. Numerous cotton-wool applicators are needed to mop away mucus and blood, a suction-pump is useful, and the application of cocaine and adrenalin is often of great assistance.

The after-treatment consists in absolute rest of the voice for three or four days, and this should be prolonged to two or three weeks if there be, as is not uncommonly the case, any accompanying redness or thickening of the cords. For professional voice-users correct vocal production is of great importance, and any nasal obstruction which interferes with proper production of the voice should receive appropriate treatment. Recurrence is probable unless the growth is completely removed. Any small remaining stump may be touched with various caustics, such as silver nitrate, chromic or tri-chloracetic acid. A solution of salicylic acid in 90 per cent. alcohol is perhaps the most useful chemical caustic, and may be applied daily at a strength of 1 to 2 per cent., increasing to 6 or 8 per cent. The writer prefers the galvano-cautery in the treatment of the stump of a growth on the vocal cord ; the point must be fine, so as to become heated and cooled instantaneously ; it is, of course, introduced cold, and only heated when in position and in full view.

PACHYDERMIA LARYNGIS.

Pachydermia laryngis is characterised by the formation of epithelial thickenings in the posterior commissure and on the vocal processes. It may be considered to be an extension of simple chronic laryngitis. The causes of irritation are predisposing factors ; misuse of the voice (especially gross misuse as in hawkers), alcohol, tobacco, syphilis, pulmonary tuberculosis, and nasal obstructions and discharges. Cauterisation and removal with forceps are very seldom advisable, and only when a definite localised projection interferes with the approximation of the cords. In treatment, general measures must largely be relied on ; vocal rest and avoidance of the cause of irritation, which must be carefully sought for. Small doses of potassium iodide, or the yellow proto-iodide of mercury (gr. $\frac{1}{8}$ three times a day), may be considered of value. Of local applications, salicylic acid (1 to 8 per cent. in 90 per cent. alcohol) and silver nitrate (10 to 60 gr. to 1 oz. of water) are the most efficacious. They must be applied carefully to the thickened regions, and the weaker solution used at first, with gradual increase in the concentration. To be of use the applications must be made daily, or at least every other day, over a period of several weeks.

Singer's nodules may be considered as a variety of pachydermia. They appear as a minute nodular thickening on the edge or upper surface of the cord at the junction of the anterior and middle thirds of the glottis. In spite of their name they are not common in trained singers, but occur more often in those who use the voice much without training in production, especially in women school-teachers ; the dust from a blackboard appears to be an additional factor. Large nodules should be removed with sharp forceps, in the same way as other benign growths, care being taken not to remove too much. Small growths often disappear under complete vocal rest and absence of irritation. The galvano-cautery is particularly useful for nodules too small and too sessile to remove with forceps. The greatest care is necessary to burn only the thickening and to cauterise very lightly, lest the subsequent contraction cause a depression on the edge of the cord. It is far better to do too little than too much, and to repeat the process later if required.

MULTIPLE PAPILLOMATA IN CHILDREN.

Multiple papillomata in children require special mention. They grow from any part of the larynx, and extend into the subglottic region and even down the trachea, and may completely fill the laryngeal cavity. They produce hoarseness, followed by dyspnœa, and usually recur obstinately after removal. Recurrence tends to cease about puberty. Before the introduction of the direct method the treatment of these growths was extremely difficult. Now, however, it is a comparatively simple matter to remove them under chloroform anæsthesia with the direct laryngoscope and a straight forceps. When they are very numerous more than one sitting may be required before removal is complete, and the child must be kept under observation and recurrences treated when symptoms point to their return. If severe dyspnœa are present when the child is brought up for treatment, a preliminary tracheotomy should be performed; the wound may be closed when the growths have been extirpated, provided that recurrence can be treated promptly.

As the direct method may not yet be accessible in every case, the principles of treatment previous to its introduction may be mentioned. Thyrotomy is unjustifiable, for there is a distinct risk of injury to the voice, and the operation in no way prevents recurrence of the growths. The best plan was to train the child by repeated laryngoscopic examination in such a way that removal by the indirect method became possible, and could be repeated as often as recurrences occurred. This could often be done in amenable children over the age of six or seven. In younger and in intractable children the combined chloroform and cocaine anæsthesia of Scanes Spicer might be employed. The method is not free from danger, and an experienced anæsthetist is required, for chloroform must be given to a full degree in the sitting posture; cocaine on cotton-wool applicators is then applied to the pharynx and larynx, and the growths removed with the aid of the laryngoscope mirror. The only alternative was to perform tracheotomy and leave the case until old enough for removal under local anæsthesia, but the dangers of prologned wearing of a tracheotomy tube are considerable in children. Occasionally the growths have disappeared after tracheotomy.

HAROLD BARWELL.

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MALIGNANT GROWTHS OF THE LARYNX.

There is ample justification for hope of a therapeutic, especially of a sero-therapeutic cure for malignancy, but as yet no treatment other than surgical has been proved to be of value in arresting the progress of malignant disease of the larynx. Endo-laryngeal extirpation is inadequate, therefore unjustifiable, except for diagnosis. All surgical procedure is based on the not unfounded assumption that if cancer is, in its beginning and for some time thereafter, a local process, it should be eradicable by local measures (Virchow). The cures by thyrotomy are ample proof of this. Lymphatic leakage is of slow progress from the larynx, and with a clear understanding upon the part of the general practitioner and of the laity of the frequently malign nature of chronic hoarseness, the early operation of thyrotomy will leave little to be desired. The contra-indications to any operative interference other than palliative are: impossibility of entire removal, a high degree of malignancy, metastatic foci, organic disease, feebleness and alcoholism. Had all of these contra-indications been, in the past, strictly regarded as prohibitive, laryngeal surgery would be the brightest spot in the whole realm of the treatment of malignant disease. For the determination of the best operative procedure it is necessary to decide whether the case in question falls under one or the other of two classes, extrinsic or intrinsic.

Intrinsic Cases are those where the growth is situated upon the vocal cords, the ventricular bands, in the ventricle or beneath the cords within the limits of the larynx. In these cases, if the growth is of limited extent, thyrotomy affords the most brilliant cures recorded anywhere in the surgery of malignant disease. But to get this result it is absolutely essential that the growth be well within the limits mentioned, and that it be of very limited extent. If the growth is more extensive, but still intrinsic, and especially if it is found to involve the thyroid cartilage or the thyroid perichondrium, or so closely to approach these structures that the intervening normal is insufficient, a partial laryngectomy is indicated. Adrenalin solution is of assistance in the definition of the growth (St. Clair Thomson). In some instances, operation will reveal otherwise undiscoverable extension (St. Clair Thomson). Cutting through a growth is always contra-indicated because of the danger of cancerous wound infection.

Extrinsic Cases are those where the growth involves the epiglottic folds, the inter-arytenoid space or the arytenoid bodies. In determining this involvement it is not alone the enlargement that is to be considered evidence of infiltration. The slightest halting of the motility on the involved side, even though without any apparent enlargement, indicates that infiltration has commenced in the arytenoid body, and that the case is not one for thyrotomy. Upon this decision hinges the successful treatment of malignant disease of the larynx. In extrinsic cases the growth may be removed by total laryngectomy, partial laryngectomy, hemi-crico-arytenoidectomy, or subhyoid pharyngotomy. In cases showing involvement only of the epiglottis, or ary-epiglottic folds, or the summits of the arytenoids, the most easy access for extirpation is by subhyoid pharyngotomy. Repullulation of an imperfectly eradicated growth is certain. Hence the disease must be followed wherever it may lead, and a wide area of normal tissue must be removed together with all effluent lymphatics. This may mean the exsection of the larynx and portions of the trachea, pharynx, œsophagus, tongue, pneumogastric nerve, carotid arteries and jugular vein. The consent or declinature of the patient to these more extended operations should be obtained before thyrotomy.

Thyrotomy, the indications for which have been given in the foregoing, has been proved to be a cure for selected cases of cancer of the larynx, first by Sir Felix Semon and Sir H. T. Butlin, later by eminent laryngologists in different parts of the world. It consists in dividing the larynx in the median line through an external incision, the retraction of the divided lateral halves of the thyroid cartilage, and the removal of the growth with a wide and deep area of normal basic tissue from the ample field thus exposed. It may be done under general or local anæsthesia, or, as is usual, both combined, cocaine and adrenalin being applied to the mucosa after the interior of the larynx is exposed. Aspiration of blood and secretions is prevented by posture or the tampon cannula. The essentials to success are an early diagnosis, a properly selected case, a clean mouth, an aseptic technique, vigilant after-care, and a patient free from organic disease other than the laryngeal lesion. He must also be free from the depressant effects of heavy doses of potassium iodide, often used for diagnosis. The operative mortality has been very much reduced in recent years, and now varies from no deaths in twenty-two operations to three deaths in forty-one operations. Representative statistics of results of modern methods are those of Sir Felix Semon, one death in twenty-five operations, and Sir H. T. Butlin, one death in twenty-three operations. The chief causes of death have been sepsis and pulmonary complications usually favoured by pre-existing organic disease. The proportion of fatal recurrences varies from three out of twenty to eleven out of forty-one cases. Representative results are those of Sir Felix Semon, three out of twenty-two cases, with 76 per cent. of lasting cures. Sixteen of his cases were known to be well after periods varying from three to sixteen years. Recurrences are, of course, usually re-operable by thyrotomy or laryngectomy. Reappearance of the same or another type of malignancy in a situation remote from the site of operation, some years thereafter, may be regarded as a re-infection of a vulnerable soil rather than a repullulation of the primary process. Occurring within a less period they may be regarded as metastases, but both classes of case are so rare after thyrotomy as to be a negligible quantity. Vocal results after thyrotomy are remarkably good, and we are justified in promising the patient that he will have, after some months or a year, good loud phonation, only slightly roughened, possibly slightly altered in pitch and lessened in flexibility. Even a degree of singing voice has been attained in a number of instances.

Partial Laryngectomy.—When laryngeal malignancy has extended either too far upward, backward or outward to permit of complete removal by thyrotomy more or less of the framework of the larynx may be removed with very good results, though they are not quite so good as those of thyrotomy, either as to operative mortality or recurrence. Vocal results are nearly as good as those of thyrotomy. Where partial laryngectomy suffices to give the wide removal of apparently normal basic tissue, it is vastly preferable to total laryngectomy. A form of partial laryngectomy, known as hemi-crico-arytenoidectomy, is occasionally of service in preserving a portion of the laryngeal framework. A portion, even though small, of this framework gives the patient a useful voice, and usually normal oral and nasal breathing. Occasionally, collapse of the soft parts, during the negative pressure of inspiration, will necessitate the permanent wearing of a tracheal cannula. If the extent of disease is found to necessitate removal of the epiglottis as well as of part of the larynx, the danger of post-operative aspiratory pneumonia is very much increased, and in the author's opinion the patient is very much safer with the entire larynx removed and the trachea stitched to the skin. Amputations of the epiglottis are of themselves not long followed by aspiration of secretions, but when associated with partial laryngectomy they seem to predispose to aspiratory pneumonia, possibly because of impaired expectoration, impaired functions of the ventricular bands and impaired glottic closure.

Laryngectomy.—There can be no question at the present day about the preferability of thyrotomy for all intrinsic laryngeal malignancy of limited extent, but unfortunately too many cases are extrinsic by origin or extension when first seen. All of these cases are absolutely hopeless except for the prolongation of life with a chance of cure afforded by laryngectomy or subhyoid pharyngotomy. The high mortality of the earlier operations was due, among other things, to the flow of secretions, pus and blood, down the open end of the amputated trachea. To obviate this, the modern surgeon follows Solis Cohen's plan of bringing the trachea forward and suturing it to the skin. The only serious disadvantage in this is the loss of voice, which is usually compensated for by the development of "buccal speech." By filling the pharyngeal pouch with air and expelling it, an intelligible and quite audible power of speech is developed in time. Various artificial larynges for phonation have been devised, the latest and best being that of Woods, of Dublin. The functions of the pharynx, where this is resected, are restored, as advocated by Gluck, by the turning inward of a flap from the neck, taking care to avoid hair-bearing epidermis. The epidermal epithelium acquires a slippery surface and takes on the function of a mucosal surface. If much of the œsophagus has been removed stenosis is apt to follow and gastrostomy may be necessary, and where this can be foreseen it is advisable as a preliminary.

The mortality of the operation varies in the statistics of different operators from 10 to 53 per cent., the chief factors being shock, sepsis and pneumonia. Ultimate fatal recurrence varies from 40 to 60 per cent., so that perhaps less than 20 per cent. of definite cures can be claimed. Life, however, is prolonged for one or more years in more than half the cases operated upon. These figures are only crude estimates, because the work of different operators varies so widely, not perhaps so much from varying skill as from the pre-operative condition of the patient. Many surgeons operate where there is the slightest hope, others select only those cases in which the chances are good. Delavan's opinion is that laryngectomy has added nothing to the sum total of human life. General anæsthesia is usual, though the operation has been done under local infiltration analgesia. Preliminary gastrostomy simplifies the feeding after operation, and, in the author's opinion, lessens mortality. Preliminary tracheotomy is done by some, the larynx being afterward extirpated from below upward. Others favour commencing above, close to the hyoid bone, freeing the larynx from its attachments, bringing the trachea forward and anchoring it to the skin before it is severed, after which it is carefully stitched to the integument.

Palliative Treatment.—For the relief of the dyspnœa, tracheotomy is usually required sooner or later, and it should not be postponed too long. If the œsophagus is invaded, dysphagia will require the feeding tube, and in some cases gastrostomy. Local pain and dysphagia may be relieved by insufflations of orthoform, 30 gr. (grammes 2), to which is added ¼ gr. (gramme ·016) of morphine sulphate. The whole of this may be blown in with a small hand-ball insufflator with curved tip. This is to be repeated only when absolutely necessary for the relief of pain or to permit the taking of food. Cocaine in the same dosage may be substituted for or added to the morphine, but it is of less duration and efficiency. Watery solutions may be used with the atomizer. Fœtor can be relieved by thorough cleansing with potassium permanganate in 2 per cent. strength. Hydrogen peroxide is an efficient cleanser, but if secretions are not first cleared away a thick tough coagulum will be troublesome. Carbolic acid, 1 min. to the ounce of rose water, is a deodorant and anodyne.

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ŒDEMA OF THE LARYNX.

Œdema of the laryngeal mucosa is due to excessive serous effusion in the lymphatic spaces of the sub-mucous connective tissue, and it may involve any portion of the mucous membrane covering.

Clinically we distinguish two varieties: (1) Inflammatory œdema, primary or secondary. (2) Simple passive non-inflammatory œdema.

Acute Inflammatory Œdema.—No case of acute inflammatory œdema of the larynx should be regarded lightly; they may prove slight, but very often they are rapidly fatal. The dangers are twofold: (1) Toxic, with general asthenia and rapid heart failure; (2) mechanical, due to obstruction of the respiratory passages and asphyxia.

The patient must be kept in bed in a warm room and the larynx inspected from time to time so as to watch for any indications that the œdema is spreading or is likely to necessitate tracheotomy. Except in mild and localised œdema, polyvalent antistreptococcus serum should be injected, and it is well to give large doses, say 20 to 30 c.c., followed within four to twelve or twenty-four hours with a further 20 to 30 c.c., according to the potency of the serum and the exigencies of the case. If the condition of the larynx does not improve the antistreptococcus serum may be aided by mixed staphylococcus and streptococcus vaccines, beginning with small doses (*see* Vaccine Therapy). In view of the possible developments of a case, it is desirable to have cultures made from swabbings from the throat as early as possible, as of course the information afforded by the bacteriological findings may be of very great assistance when the patient's condition gives rise to anxiety, although, on the other hand, it may fortunately prove that such precautions are unnecessary. Many years ago I saw, in consultation, a medical colleague who had a moderate tonsillitis and an œdematous epiglottis, and gave a bad prognosis, but failed to convince the attending physician that there was much danger, as the case appeared so relatively slight and even to be improving, because the discomfort decreased as his tonsillitis subsided. I was not asked to see the patient again, but within forty-eight hours our friend died from rapidly developing heart failure. I have heard of several similar experiences since that time, but it taught me to be more emphatic in urging the need for caution in these very treacherous conditions.

Apart from the employment of sera or vaccines, acute inflammatory œdema should be treated on the same lines as a severe acute catarrhal laryngitis and the application of a mustard poultice or of leeches externally, and the sucking of ice may be tried with advantage. I do not think one should scarify the œdematous area unless dyspnœa is threatening, and it is probably safer to perform tracheotomy, or at any rate to intubate rather than scarify the area of cellulitis. When it is impossible for any reason to overcome the danger of suffocation by tracheotomy or intubation it is certainly better freely to scarify the œdematous area, but unless the patient refuses tracheotomy it is unlikely that any practitioner who is prepared and is able successfully to scarify a larynx has not been able to prepare for tracheotomy or intubation. If tracheotomy is performed the trachea should be opened low down, so as to get as far away from the œdematous inflammation as is justifiable. But if circumstances permit, intubation is preferable to tracheotomy, as it avoids making an open wound, and as the acute obstruction seldom lasts more than twenty-four to forty-eight hours there should be little danger of causing ulceration from pressure if the procedure is skilfully performed.

While emphasising the importance of sera and vaccines in cases of septic laryngitis, I do not suggest that these are the only therapeutic measures to employ. Quinine is of distinct value, the sulphate being given in doses of 3 to 6 gr. every four hours; while digitalis, iron and strychnine are most necessary in most of the severer cases, particularly when the heart's action is weakened.

In the milder cases of laryngeal œdema, in which the œdematous area is localised and does not cause respiratory obstruction and is not accompanied by marked febrile or general disturbance, it is generally sufficient to keep the patient warm in bed with directions to avoid using the voice, to take cold fluid food, and to apply a mustard leaf or a mustard and linseed poultice externally.

Secondary Inflammatory Laryngeal Œdema is usually a far less dangerous condition than the class of cases just described as primary acute inflammatory œdema. Secondary œdema of the larynx may be due to syphilis, cancer or tuberculosis, or it may be secondary to perichondritis. In moderate degree it is by no means rare in such diseases, but it is very rare for secondary œdema *per se* to endanger life. When a tertiary syphilitic lesion or a tuberculous deposit is associated with œdema threatening asphyxia it is possible to avert the danger to respiration by intubation or by puncturing the œdematous area in several places, but it is generally better to resort at once under such circumstances to tracheotomy, for although both syphilis and tuberculosis are amenable to treatment, the mere fact of putting the diseased larynx at rest by making the patient breathe through a tracheotomy tube tends to help the diseased tissues, lessens the associated inflammatory swelling, and makes it much more probable that general or local treatment will be attended with success. With a cancerous growth any reduction in the size of the growth short of its eradication is too remote a contingency to hope for, and therefore to perform tracheotomy would be the proper course when laryngeal obstruction arises. Hence while secondary laryngeal œdema may arise in these diseases no special local treatment of the larynx is called for.

Acute Passive Œdema of the larynx develops in a chronic renal disease with or without general anasarca, and more rarely still in diabetes and obstructive valvular heart disease.

Non-infective Inflammatory Œdema, as already mentioned, may arise from scalds and injuries to the larynx. When it does not threaten to cause dyspnœa, rest and the continuous application of cold externally and sucking ice should be ordered, but if dyspnœa is threatened, these procedures should be followed up by scarification of the œdema, or by intubation or tracheotomy.

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PERICHONDRITIS OF THE LARYNX.

Any deep-seated inflammation of the larynx must affect the perichondrium, and perichondritis is, therefore, a necessary accompaniment of many cases of tuberculous, syphilitic and malignant disease of the larynx; but it only becomes a clinical entity in these cases when secondary infection has produced suppuration or necrosis. Acute perichondritis also occurs as a complication of typhoid fever, small-pox, diphtheria and, rarely, pneumonia; it may be due to traumatism or, apparently, may arise spontaneously. Except in cases of tuberculosis, syphilis or cancer, the cricoid cartilage is most often attacked, the thyroid cartilage more rarely. The inflammation may subside without suppuration and with or without leaving permanent fixation of a vocal cord. If an abscess forms it may point, in cricoid perichondritis, in the larynx, backwards into the pharynx, or externally in the neck. In thyroid perichondritis the abscess may extend into the neck or point in the pyriform fossa; whilst an artyenoid abscess usually ruptures near the vocal process. An extensive brawny cellulitis, or even a typical *angina Ludovici*, may be present in the neck.

The early stage is usually very acute with high fever, and frequently a rigor. The early treatment consists in the application of ice externally and giving ice to suck. Four or six leeches on the neck, if there is external swelling, are sometimes valuable, but hot fomentations are to be deprecated. If dysphagia is severe it may be necessary to resort to nutrient enemata, as it is most important to maintain the patient's strength. Insufflations of orthoform (gr. 3 to 5) will sometimes relieve the pain and allow the patient to swallow. If an abscess forms and projects internally it should be promptly incised. This can usually be done after cocainisation by introducing the left forefinger on to the swelling and passing along it a curved, sharp-pointed bistoury, guarded to ½ inch from the point with strapping. General anæsthesia is contra-indicated by the risk of aspiration of the pus. If a swelling form in the neck, this should be incised by an external incision, and, if the case is a severe one, the practitioner should not wait for definite evidence of suppuration. When the swelling is localised the incision is made over it; but when it is badly defined it is better to cut down to the cartilage in the middle line of the neck, and to pass a director beneath the perichondrium to open up the inflamed area. General anæsthesia should not be employed, but a local anæsthetic may be injected subcutaneously. If dyspnœa is marked and not promptly relieved by these measures, tracheotomy must not be delayed.

When suppuration has occurred, necrosis of the cartilage is very likely to follow. This leads to a very protracted and exhausting illness until the sequestrum is exfoliated. When, finally, cicatrisation occurs it causes marked deformity and stenosis. The necrosed portions of cartilage should be removed as early as possible after the acute inflammation has subsided. Tracheotomy, if not already performed, usually becomes necessary with the onset of cicatricial contraction. Finally, when healing is complete, the stenosis may be submitted to dilatation (*see* Laryngeal Stenosis); but the restoration of the air-way is impossible in the severest of these cases, and the patient must continue to wear permanently a tracheotomy cannula.

HAROLD BARWELL.

STENOSIS (CICATRICIAL) OF THE LARYNX.

CICATRICIAL stenosis follows syphilitic ulceration, lupus and any form of perichondritis or necrosis of the cartilages, particularly that due to typhoid fever or variola. It also results from traumatism of any kind. The operation of thyrotomy is sometimes followed by adhesion between the anterior parts of the cords or by the formation of a web across the anterior commissure. The cicatricial tissue is generally found in the neighbourhood of the glottis or in the subglottic region, and varies from a narrow web to a deep and dense scar reducing the air-way to a narrow slit-like tube. Sometimes the lumen is entirely obliterated. More rarely, but especially, in syphilitic and lupoid cases, the contraction is at the upper aperture.

Before describing the treatment of these well-defined forms of laryngeal stenosis it will be advisable to allude to those cases in which the cannula cannot be dispensed with in children after tracheotomy for diphtheria. This is most frequently merely the result of nervousness, and due to a spasm of the adductors of the cords on attempted removal of the tube. Such cases can be cured by the use of a cannula with a fenestration on its upper side, the tube being corked at intervals during the day and the child encouraged to breathe through the larynx by teaching it to sound a whistle or blow soap-bubbles. Sometimes it appears to be due to atrophy of the laryngeal abductors both in intubation and tracheotomy cases, and sometimes to hypertrophic subglottic laryngitis. If a tube shaped in the segment of a circle is worn for a long time, the lower end of the trachea becomes pulled forwards and a spur, similar to a colotomy spur, is formed. In the large majority of cases, however, in which true stenosis has resulted, it will be found that the tube has been inserted, under conditions of urgency, into the larynx between the divided halves of the cricoid ring, or even through the thyroid cartilage. In such cases the most successful method is to perform a low tracheotomy and to close the original wound. A fenestrated tube is used and plugged for gradually increasing periods of time; but it should be worn for several weeks, continuously plugged, before it is finally removed. Under this treatment the larynx, freed from irritation, usually regains its patency. Lack[1] has reported very good results from this method while deprecating the use of laryngeal plugs or T-shaped tubes attached to the tracheotomy cannula for these cases.

The treatment of true cicatricial stenosis is exceedingly difficult, and is sometimes, particularly in severe syphilitic and post-typhoid cases, beyond the reach of present surgery. The patient is then doomed to a permanent tracheotomy. The greatest patience is needed on the part of both surgeon and patient to achieve a successful result. Several methods have been, and still are, employed. They may be classified as follows: (1) The insertion of a dilator, fixed below to a tracheotomy cannula; (2) the intermittent passage of a dilator by the mouth; (3) intubation; and (4) the operation of laryngostomy. Cicatrices may also be divided *per vias naturales*, or cut away by thyrotomy, before dilatation is carried out. A preliminary tracheotomy is necessary in order to put the patient out of danger of suffocation, except in a very few cases where dilatation by intubation is being practised and the patient shows no inclination to cough out the tube, and is within reach of immediate aid should he do so. The dilatation of syphilitic strictures must, of course, only be attempted when the last trace of active disease has subsided.

Fixed Dilatation.—When tracheotomy has already been performed, an attempt may be made to dilate the larynx by means of an apparatus attached to the tracheotomy cannula and passing upwards. Störk's dilator consists of two sliding arms, which can be separated to any extent required. Schimmelbusch's consists of a flexible metal tube, while Lack's metal plug, being solid, can be longer retained without removal for cleaning. Such plugs are worn for gradually longer periods until dilatation appears to be established. They are then very slowly omitted, being worn at first every other day, and finally for one day in the week. The tracheotomy tube must be kept in for some weeks after the dilator has been finally left out, and must only be removed when there is no further appearance of re-contraction. The greatest care is needed to avoid the formation of pressure ulcers, and the dilator can at first only be worn for a short period in each day, while in some cases the method is too painful. Most of these dilators have the disadvantage that they do not fit the shape of the laryngeal lumen. From this point of view Lack's instrument is the best, or a dilator may be specially made to the requirements of the individual case. When the stenosis is due to firm cicatricial tissue it is first necessary to divide this. When the stricture is permeable and in the form of a web or an adhesion between the cords, this can be done through the mouth under guidance with the laryngoscope by means of Whistler's guarded knife or, better, by a laryngeal knife, such as Tobold's, shaped like a curved probe-pointed bistoury. The incision is usually best made in the anterior direction. When the scar is very deep or dense it must be dissected away through a thyrotomy incision.

Intermittent Dilatation.—This method consists in passing a bougie by the mouth. Schrötter's vulcanite bougies (Fig. 1) are suitable; they are triangular in shape to fit the lumen of the glottis, and are made hollow to permit of respiration. They are introduced either by aid of the laryngoscope or guided by the left forefinger over the epiglottis, and are retained for as many minutes as possible. Thorough cocainisation is necessary at first, but later the patient becomes more tolerant. The bougies must be passed daily in gradually increasing sizes for many months and then gradually intermitted, but the patient must be kept under observation for at least twelve months after the last passage of the instrument.. This treatment may, when advisable, be preceded by incision of the stricture.

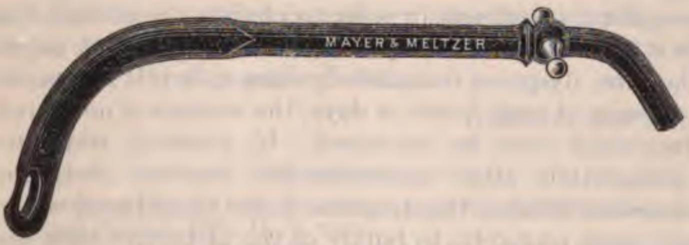

FIG. 1.—Schrötter's hollow vulcanite bougie.

Intubation.—The treatment of stenosis with .modified O'Dwyer's tubes has been practised with considerable success by John Rogers and Bryson Delavan,[2] of New York. If the stenosis is considerable, a preliminary tracheotomy is desirable on account of the danger of rapid asphyxiation in the event of the tube being coughed out. An important factor in success is the accurate estimation of the size and shape of the tube, which must be specially made for the individual case. A general anæsthetic is first given, and, by passing successive "normal" tubes, one is found in which the retaining swell distends the constriction to the limit which it will bear without sloughing. A "special" tube is then made with a retaining swell of this size, but with a neck larger than the normal in order to dilate the stricture.

To prevent its being coughed out, however, the transverse diameter of the neck must be $\frac{3}{32}$ inch smaller than that of the retaining swell, and the head must have a diameter of $\frac{6}{32}$ inch greater than the retaining swell to obviate the danger of its slipping down into the larynx. When, however, a tracheotomy wound exists, it is better to employ one of Rogers's "clamped" or "plugged" tubes, in which a clamp or plug is passed through the wound and firmly attached to the intubation tube. This apparatus, then, approximates to those employed in the treatment by dilators attached to a tracheotomy cannula, and the greater success appears to be due to the accuracy with which the dilating tube can be fitted to the size and shape of the laryngeal cavity. Delavan states that these intubation tubes only have to be removed for cleaning about once in four or six weeks, and that one has been worn without removal for two years. The tube may have to be worn for as long as four years. When a cure may be expected to have resulted, extubation should be performed under general anæsthesia in order to obviate the adductor spasm which is liable to occur after prolonged intubation. If, on removing the tube, dyspnœa immediately ensues, or if it returns slowly in the course of some hours or days, the stenosis is not cured and the treatment must be continued. If, however, respiration is free immediately after extubation but becomes obstructed as consciousness returns, the dyspnœa is due to adductor spasm or, perhaps more probably, to failure of the abductors from disuse; in this event a tube with the narrowest possible neck must be introduced in order to allow some movement of the cords. After four or six weeks extubation is again performed under anæsthesia and morphia administered to allay spasm. In a successful case there will be no further difficulty, but the surgeon must not leave the patient for the first few hours unless there is an opening in the trachea.

The Operation of Tracheo-laryngostomy.—An incision is made in the middle line, as for a thyrotomy, from the previous tracheotomy wound to the upper border of the thyroid cartilage; the thyroid, cricoid and tracheal rings are divided with scissors, and the mucosa of the larynx and trachea stitched to the skin. The cicatricial tissue is then very completely excised, a full-sized rubber tube placed in the air-passage and a fenestrated tracheotomy cannula introduced through an opening in the rubber tube. The wound is left entirely open and must at first be dressed very frequently, as discharge is free. The mouth must be kept carefully clean, and for the first few days the patient should be fed by a spoon or by the nasal tube. Dilatation is continued for a time, varying from three to twelve months, and when all the parts are covered with epidermis the cannula is removed for three or four hours a day while the wound is closed with strapping, in order to give the patient full confidence in the patency of his air-passages. Finally, the external wound is completely closed by a plastic operation.

It is not yet possible to state which of these various methods is absolutely the best. The writer has treated a severe case with complete success by means of Schrötter's bougies, after division of the scar. This method has the further advantage of interfering but little with the patient's occupation. Dilatation from below will probably be superseded by intubation with the special tubes which can be very accurately adapted to the individual case. It would appear to be far safer when employing intubation to use a tube fixed by a clamp through the tracheotomy wound. A considerable number of successes have been achieved by laryngostomy, but the operation is a severe one; the mortality so far is 16·6 per cent., and the method should be reserved for those cases in which all other methods fail.

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SYPHILIS OF THE LARYNX.

One or two points deserve notice in reference to the **general treatment** of laryngeal syphilis. During the tertiary stage, when there is active ulceration or perichondritis, the patient should be kept in bed on a light, alcohol-free diet, and carefully watched for evidences of respiratory obstruction. Slight dyspnœa may rapidly increase under treatment by potassium iodide, and it should be remembered that tracheotomy may in some cases be avoided by rest in bed and mercurial inunctions, potassium iodide being given a few days later, when the obstruction has diminished.

Under ordinary circumstances laryngeal lesions heal rapidly under potassium iodide alone. Cases are however met with which require the addition of mercurial treatment, either in the form of liq. hydrarg. perchlor., $\frac{1}{2}$ to 1 drachm [U.S.P. hydrarg. chlor. corrosiv. gr. $\frac{1}{32}$ to gr. $\frac{1}{16}$], added to the potassium iodide mixture, or, better, by means of inunction or subcutaneous injection.

During the secondary stage no **local treatment** is required, and even during the tertiary stage local applications, so much in vogue at one time, are, as a rule, best avoided. In exceptional cases, however, when an ulcer tends to bleed or becomes covered with exuberant granulations, its surface should, under cocaine anæsthesia, be cauterised with solid silver nitrate, introduced on a proper laryngeal caustic carrier, such as Schrötter's. When muco-purulent discharge tends to accumulate in the larynx it should be loosened by the use of an alkaline spray consisting of bicarbonate of soda and borax, 15 gr. of each to 1 oz. of water. The apparatus should be provided with a laryngeal nozzle, which is introduced close to the posterior wall of the pharynx, the patient inhaling deeply when the bulb is compressed. After cleansing, the ulcerated surface may be powdered, by means of a laryngeal insufflator, with calomel or iodoform, the latter being used with an equal amount of orthoform if there is pain.

When respiratory obstruction is present and is due to œdema about the entrance to the larynx, in addition to the general treatment mentioned above, the œdematous parts should be scarified with a properly guarded laryngeal knife, and the patient should be given ice to suck. A careful watch must be kept, and tracheotomy not too long delayed. Local treatment further consists in the opening of perichondritic abscesses and the removal of sequestra and fibrous granulomata.

After healing is complete adhesions and cicatricial contractions not infrequently require treatment, which may consist of intermittent or continuous dilatation, the removal of webs or cicatricial tissue by means of direct or indirect laryngoscopy, or such operations as thyrotomy or tracheolaryngostomy.

THOMAS GUTHRIE.

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TUBERCULOSIS OF THE LARYNX.

Laryngeal tuberculosis is, with extremely few exceptions, secondary to pulmonary tuberculosis, and is due to surface infection through the sputum. It assumes a great variety of forms, which may be divided for practical purposes into two classes: namely, lesions confined to the interior of the larynx and those which affect the upper aperture. The invasion most frequently takes place on the inner faces of the vocal processes, and may produce deep ulceration, baring and excavating the arytenoid cartilages. Other common lesions are on the vocal cords and in the inter-arytenoid space, where a characteristic velvety infiltration may be seen. When the upper aperture is attacked, the lumen of the larynx has usually already been affected. The infiltration generally begins in the arytenoid region, producing the typical semi-translucent swelling, and spreads thence to the epiglottis. Occasionally the epiglottis is affected first, sometimes even before the interior of the organ, and there is a chronic "lupoid" form of ulceration, which is confined to the epiglottis, is attended by comparatively little discomfort, and occurs in cases of very chronic pulmonary disease. The form in which the upper aperture is affected is by far the more serious and difficult to treat, for the sub-epithelial tissue being here abundant, a large quantity of tuberculous material can be deposited beneath unbroken epithelium, and this "massiv infiltration" is less accessible to treatment than a superfici ulcer. Furthermore, the disease in this region gives rise to th most serious symptom of this affection, namely, dysphagi which, by preventing proper nutrition, speedily undermines th patient's resistance.

Indications for Treatment.—The two most important factor which should decide our line of treatment are the state of the lungs and the laryngeal symptoms. The laryngeal complication very often occurs in the latest stages of consumption, when anything but palliative treatment is out of the question. It is, however, present, and far more often than is generally supposed, in an early stage of the pulmonary disease, and is quite frequent in the large class of patients suffering from chronic and partly quiescent pulmonary tuberculosis, who would but for this have the expectation of many years of life. The laryngeal lesions ought to be actively treated in all cases in which the pulmonary disease is in an early stage and not rapidly progressing, and even in somewhat more advanced cases if they show a tendency to improve under general treatment. In a very good proportion of such cases definite healing can be obtained. In some instances early laryngeal lesions heal spontaneously under favourable hygienic conditions, but there is no doubt that a much greater number can be cured by a combination of local and general treatment. On the other side are the cases of advanced or rapidly progressive pulmonary tuberculosis, with rapid loss of weight, hectic fever or severe cachexia. In such the indiscriminate employment of active measures only tends to bring a useful method into disrepute. If there are no severe symptoms, only the mildest palliative treatment is to be used ; if dysphagia is present, local anodynes are indicated; but if they fail to bring relief, as not uncommonly happens when the arytenoids or epiglottis are severely implicated, the excision of the latter, or removal of a small piece from the former, will nearly always immediately improve and often quite abolish this distressing symptom. The operation takes but a few moments and is almost painless under cocaine.[1] The large class intermediate between these two groups includes those cases of chronic pulmonary tuberculosis without high fever or marked debility, but in which the lung disease is so far advanced that a definite cure cannot be expected. Here the desirability of active treatment must be decided for each case individually, and the patient should first be kept under observation for a few weeks and the progress of the weight and temperature considered. A lesion, such as an infiltration in the posterior commissure which is causing no symptoms, may be watched and left alone if it does not progress, while an infiltration of the upper aperture, which will shortly cause dysphagia, should be attacked without delay. In many cases of chronic pulmonary tuberculosis a local cure of the laryngeal lesions can be obtained and life in this way prolonged, whereas when the disease progresses unchecked, dysphagia generally supervenes and the patient dies a painful death.

General Treatment.—Open-air treatment is of the greatest importance, even when the laryngeal lesions are advanced, and is only contra-indicated by acute laryngitis. A warm, moist climate is favourable to the laryngeal affection, and even an excessive rainfall harmless, but a dry, windy and dusty district is unsuitable. Cases of advanced tuberculous laryngitis should not be sent to the high-level resorts of Switzerland, and it is unwise to send abroad and far from their friends those in whom severe symptoms may suddenly develop. The use of tuberculin is described elsewhere (*see* Tuberculin Therapy). Of its employment in cases of tuberculous laryngitis it may be said that the method is even now *sub judice*, that tuberculin is a powerful poison requiring great care in administration if it is not to do harm, and that while this is so, cases of pulmonary tuberculosis complicated by tuberculous laryngitis are not particularly good subjects for its employment. While the writer does not think that the laryngeal complication in an early stage contra-indicates the use of this method where it otherwise appears suitable, he has not been able to convince himself that any benefit has accrued to the local condition by its employment in cases under his observation. Complete rest of the organ is of great value, and surprisingly good results are sometimes seen if the patient keep absolute silence over a prolonged period.[2] A loud whisper is at least as disturbing to the larynx as ordinary speech. Absolute silence, however, often has a very depressing effect, and should not be insisted on in advanced cases where it is unlikely to do good. This rest is impossible when cough is severe, and every effort should therefore be made to control this symptom. Heroin hydrochloride is often very useful for this purpose, and may be given in a lozenge or linctus in doses of $\frac{1}{12}$ to $\frac{1}{16}$ gr.

Palliative Local Treatment.—Of palliatives to relieve discomfort, steam inhalations at 140° F. containing Friar's balsam (ʒj, ad Oj) may be employed, but the author prefers oily solutions in a nebuliser and finds menthol beneficial. A good prescription is menthol, ʒss; camphoræ, gr. 5; chloretone, gr. 10; ol. cinnamomi, ♏1; ol. olivæ, ℥j; paraffinum liquidum, ad ℥ij. Intra-tracheal injections act in a similar way, and are sometimes very useful in relieving the discomfort in cases of advanced ulceration; the writer employs liquid paraffin containing menthol (1 per cent.), or naphthalene or guaiacol (2 per cent.), at a temperature of 90° F., and injects about ½ oz. The syringe is introduced with the aid of the laryngoscope and passed between the cords, when the injection is made steadily during a slow deep inspiration. When dysphagia is present, the local application of anodynes is required. Of these orthoform is the most suitable, as it is not toxic. Its anæsthetic effect often lasts for twelve hours or more; it takes twenty or thirty minutes to develop fully. It is an insoluble powder, and is administered by insufflation in doses of 3 to 5 gr. The patient can introduce it for himself by aspirating it from a watch-glass through a curved Leduc's tube or, more simply, through a straight glass tube, by putting the powder into one end and introducing the other end far into the mouth, when a sharp inspiration will draw it into the larynx. Anæsthesin is occasionally successful when orthoform fails, or the two drugs may be combined. Morphine and cocaine should only be employed in advanced and hopeless cases, for, apart from their mental effect, they cause a loss of appetite which is very detrimental to consumptive patients. Morphine is best given as an insufflation in doses of ¼ gr., diluted with 2 gr. of starch or bismuth ; cocaine as a spray in doses of a few drops of 5 per cent. solution. A bland and unirritating diet must be ordered ; semi-solids are usually more easily taken than fluids, and milk is unfortunately often especially difficult. Wolfenden's posture is often helpful while drinking ; in this method the patient lies prone on a couch, with his head beyond the edge, and sucks up the liquid through a glass tube from a vessel placed a few inches below the level of his mouth.

Another method has recently been employed with encouraging results for the relief of dysphagia. It is an adaptation of the treatment of severe neuralgia introduced by Schlösser, and consists in the injection into the superior laryngeal nerve of 80 per cent. alcohol, containing 2 gr. of β-eucaine hydrochloride to the ounce. A special, bluntly bevelled needle is passed vertically for a depth of about 1½ centimètres to the site of the nerve in the space between the hyoid bone and the thyroid cartilage, and the solution slowly injected to the quantity of 1 or 2 cubic centimètres.[3]

Curative Local Treatment.—Methods designed to produce healing of the local lesions include the application of chemical caustics, curettage of ulcers, the galvano-cautery, and removal of infiltrated tissue with punch forceps. Pigments are applied on a strong cotton-wool applicator passed under guidance with the laryngoscope, and must be firmly rubbed into the affected parts ; lactic acid is the drug most widely used for this purpose, and may be applied in concentrations of 40 to 100 per cent. of the pharmacopœial acid. The smarting so produced is usually very temporary. The author generally employs a mixture, suggested by Lake, containing lactic acid (50 per cent.), formalin (7 per cent.), and phenol (10 per cent.) ; the latter drug acts as an analgesic and decidedly diminishes the smarting. The strength and frequency of the applications must be regulated by the local reaction ; good results can be obtained by their use once a week, but it is generally better to employ them daily or every other day. They are especially indicated in the common diffuse though superficial ulceration of the interior of the larynx.

Curettage is chiefly indicated in cases of ulcers or sprouting granulations on the posterior commissure, epiglottis and ventricular bands, especially when they fail to improve satisfactorily under the use of pigments. Heryng's curettes are very suitable, local anæsthesia is required, and the granulations should be removed as thoroughly as possible; an application of Lake's pigment should be made immediately after the operation, and repeated regularly as described above. The galvano-cautery is especially useful in the treatment of circumscribed lesions on the vocal cords and ventricular bands. Several repetitions are generally required at intervals of ten to fourteen days, when the eschar produced by the previous application has separated.

The cautery is also employed for the treatment of massive infiltration on the arytenoids and epiglottis, the cautery point being plunged deeply into the tissues in three or four places at each sitting. Marked diminution of the swelling and relief of discomfort often result; but not infrequently there is considerable reaction and after-pain, and the author prefers in suitable cases the removal of the infiltrated tissue with punch forceps. The objection, that this method converts a closed into an open infiltration, is purely theoretical, for it is found in practice that secondary infection does not occur, but that the wounds heal with remarkable rapidity.[4] This method is practised in two classes of case: those with dysphagia, in whom this symptom is nearly always much relieved; and those with early, chronic or quiescent pulmonary tuberculosis, in whom it is justifiable to attempt to obtain a local cure. It is not necessary to remove the whole of the diseased tissue, for after excision of a small piece from the swollen parts the remainder quickly shrinks, and less removal is

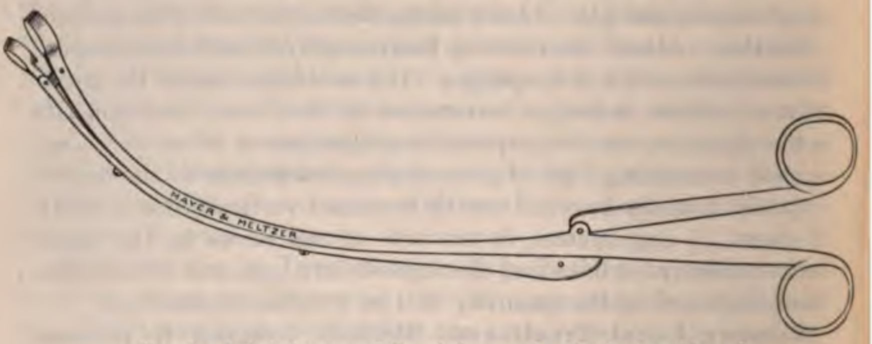

FIG. 1.—Lake's Laryngeal Punch-forceps, for the Arytenoids and Ary-epiglottic Folds.

required on a subsequent occasion than originally appeared probable. For the arytenoid region Lake's punch forceps (Fig. 1) are most suitable, and are used under guidance with the mirror. For the epiglottis the Lake-Barwell punch (Fig. 2) is convenient, as it will remove the organ at one bite, and is used directly in conjunction with a tongue depressor.

A further method recommended in this country by Watson-Williams,[5] and in America by Chappell,[6] consists of submucous injections, and is chiefly intended for cases of local tumefaction without ulceration. Guaiacol and creasote are the drugs usually employed, and are injected pure or diluted in doses of 1 to 4 minims at intervals of five or six days into regions where the submucous tissue is lax and abundant. There appears to be some danger of producing sloughing, and this method has not been widely adopted.

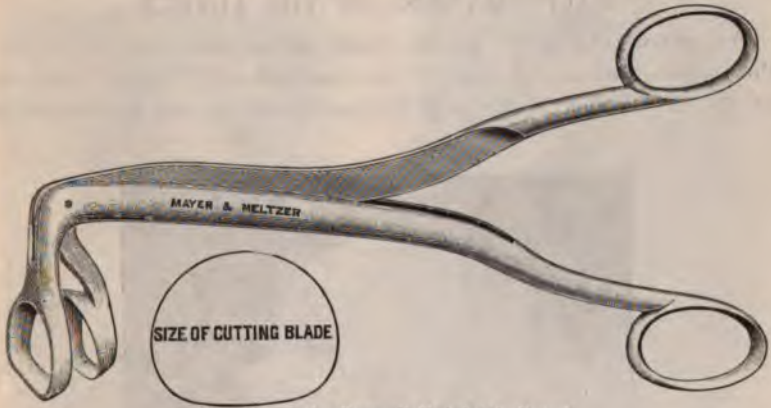

FIG. 2.—Lake-Barwell Epiglottis Punch.

HAROLD BARWELL.

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[4] Lake, R. and Barwell, H., "Laryngeal Phthisis," second edition, London, 1905.

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DISEASES AND AFFECTIONS OF THE EAR.

DISEASES AND AFFECTIONS OF THE EXTERNAL EAR.

MALFORMATIONS OF THE AURICLE.

Accessory Auricles, as the small projections seen in front of the tragus are named, should be dissected out; larger ones, such as the case under Mr. Howell Evans shown in the accompanying illustration, require a more extensive operation. It is advisable to perform these operations whilst the child is young, so that the resulting scar may be small and become assimilated as much as possible to the neighbouring skin.

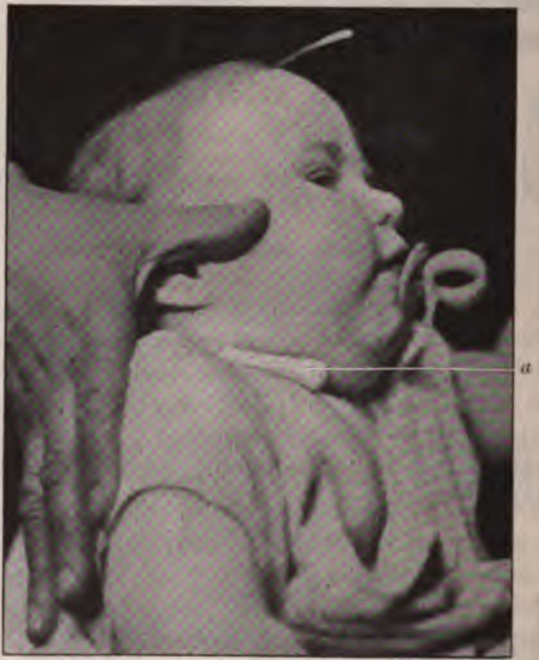
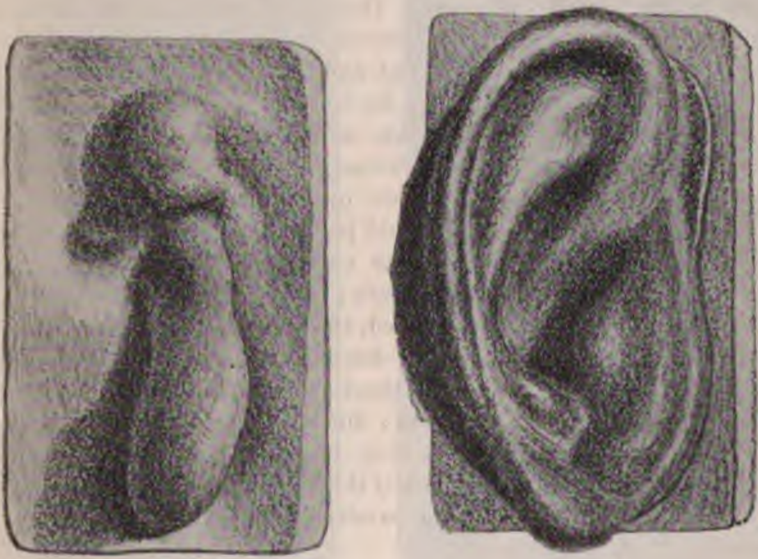


FIG. 1.
a, Cervical auricle. (J. Howell Evans.)

The auricle is occasionally replaced by a more or less shapeless mass of varying size, showing no definite anatomical distinctions. A plastic operation should be attempted, each case being treated on its own merits. However, if it cannot be converted into a satisfactory auricle, an endeavour should be made to form a good stump by removing any unnecessary tissue and then fitting an artificial ear to the stump, several good forms being now on the market.

The accompanying illustration shows: (1) Cast taken of a congenital malformation; (2) an artificial ear, fitted to the cast, and ready for the patient to wear.*



(1.) (2.)

FIG. 2.

These artificial ears are very light, about $\frac{1}{3}$ oz. in weight, and are coloured to match the complexion.

Deviated Pinna.—Castex[1] reports a satisfactory result obtained by dissecting up a large flap of skin from the inner surface of the pinna and also from the mastoid region, and then suturing the two raw surfaces together, the sutures being passed through cartilage and periosteum.

Fistulæ.—If causing an obvious disfigurement, an attempt at closing these congenital defects should be made by drawing the edges together or by the application of large skin grafts to the freshened edges of the fistulæ.

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* Made by Mr. H. Brooks, 34, Illingworth Road, Bradshaw, Halifax, Yorks.

Projecting Ears.—That form in which the whole pinna projects outwards, *i.e.*, at right angles to the side of the head and making the ears very prominent, may be dealt with by (1) conservative measures; (2) surgical procedure.

(1) Provided the child is taken very young whilst the cartilage is still soft, good results may be obtained by the application to the ear of a device, such as shown in the illustration (Fig. 3), and worn continuously for some weeks till the desired apposition of the pinna to the head is obtained. This appliance may also be used for older children, say from two to four years old, being then worn at night.

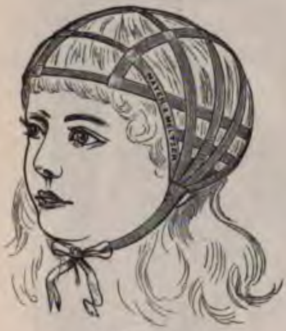


FIG. 3.

(2) An incision down to the cartilage is made along the posterior surface of the pinna, close to its attachment to the skin over the mastoid process; the skin and perichondrium is now reflected and the necessary amount of cartilage laid bare; a narrow strip of this is removed, the breadth depending on the result desired, and care being taken not to buttonhole the skin on the anterior aspect; the cut edges of the cartilage are then brought into apposition and united with buried sutures; finally the wound is sutured, any redundant skin being removed and bandages applied for four to five weeks.

Duel [2] advocates an operation on the skin of the pinna somewhat resembling Panas' operation for ptosis, stating that the deformity is due to redundant skin instead of redundant cartilage.

NEW GROWTHS OF THE AURICLE.

Malignant Growths.—Whether the new growth is an epithelioma, carcinoma or other form of malignant disease, the treatment is the same. If seen early before implication of tissues remote from the auricle has taken place, the growth, together with this appendage, should be removed, enough being left if possible, to form a stump for an artificial ear. Should the growth, however, have extended into the neighbouring structures, so that eradication of the disease is no longer possible, operative measures may still be undertaken for the relief of pain; after this, ordinary means may be adopted to promote euthanasia.

Rodent Ulcer, if small, may be excised, but a very successful result can usually be obtained by the application to X-rays. Quite recently Graham Little has obtained very satisfactory results by treating these ulcers with carbon dioxide snow, and by ionization.

Innocent Growths.—*Keloids* and *fibromata* occur on the lobule as a result of the wearing of earrings. If unsightly, they must be dissected out, and the wearing of earrings forbidden.

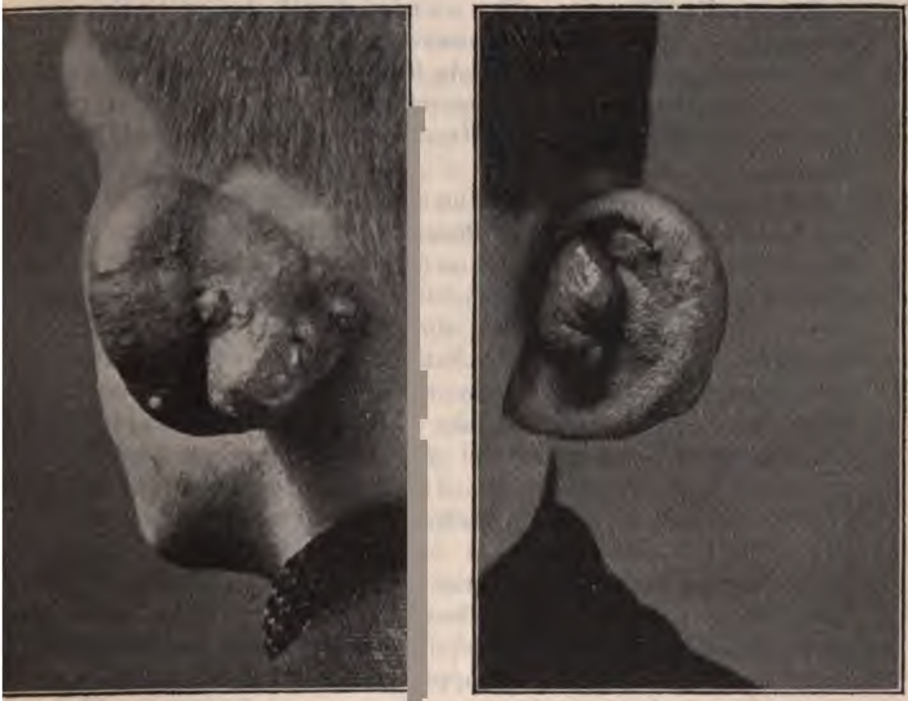


FIG. 4.—Angioma of the auricle. (Hugh E. Jones.)

Cysts, sebaceous and serous, can be readily dealt with under cocaine; the serous being opened and scraped, and then a dressing firmly applied; the sebaceous being dissected out.

Dermoid cysts should be approached under a general anæsthetic, as it is not always possible to ascertain the extent of their attachment prior to operation, a more extensive operation than appears at first sight occasionally being necessary.

Angioma, if quite small, may be destroyed by the actual cautery; if of some size, electrolysis will give the better result. H. Jones[3] published the case shown in the illustration, in which he found it necessary to remove the whole auricle after first ligaturing the external carotid artery.

Tophi do not require local treatment; as they are usually a manifestation of gout, attention should be directed to that condition.

DISEASES OF THE AURICLE.

Raynaud's Disease.—The auricle should be protected by the application of wool. If, however, any portion of the pinna becomes gangrenous it should be removed by ordinary surgical means, after the line of demarcation has become evident. At the same time, the usual general treatment for this condition must be enforced.

Erysipelas.—If confined to the auricle, one or two fomentations should be applied, and then xeroform dusted on. If extending beyond the auricle, silver nitrate solution (4 per cent. strength) should be painted on the skin outside the line of demarcation; at the same time, a purgative and tonics should be administered. Serum treatment is recommended by Nathan Raw,[4] 20 or 30 c.cm. of a polyvalent streptococcus serum mixed with 40 c.cm. of normal saline, are gently poured into the previously washed out rectum. Compresses of absolute alcohol applied to the affected area are recommended by Gustav Brühl.[5] Judd[6] recommends the application of a 95 per cent. solution of carbolic acid in alcohol by means of swabs till the affected area is rendered white, followed by the application of pure alcohol till the area becomes pink.

Herpes.—The affected area should be dusted with equal parts of zinc oxide, starch and boric acid, or with orthoform, and then protected by a pad of wool lightly applied. Should the vesicles have ruptured and the pain become severe, an ointment should be applied containing menthol; or a piece of gauze soaked in: Menthol, gr. 25; Cocain., gr. 10; Paraffinum Liquidum, ad ℥i, may be applied to the part and covered with a wool dressing. Internal treatment is not of much avail; aspirin, however, may be tried.

Telephone Ear.—A condition in which acne pustules, furuncles, and various neuroses such as pain and tinnitus, are found, is described by Blegvad.[7] Treatment consists in cessation of all use of the telephone and administration of tonics; future use of the telephone appears to give rise to a recurrence of the symptoms.

Acute Eczema.—The cause, such as an irritating soap or pediculi, must be sought for and removed; tonics, *e.g.*, syrup of iodide of iron, administered; and locally xeroform powder dusted on or calamine lotion applied.

Chronic Eczema.—Painting the affected area with a 15 per cent. aqueous solution of protargol may be tried, but the most useful remedies are mercurial ointments or ointments containing resorcin or ichthyol. Peter's ointment, viz., Ammon. Ichthyol, gr. 5 ; Zinci Oxidi, ʒij ; Vaselini Alb., ℥j, answers very well ; it is recommended that any ointment remaining from a previous dressing should be removed by pieces of wool dipped in olive oil prior to a fresh dressing being applied.

The eczematous condition of the skin on the posterior surface of the pinna and over the mastoid process, seen in the poorer classes of patients, soon clears up on the application of unguentum hydrargyri ammoniati twice a day, after previously bathing the affected area with lotio acidi boraci (7 gr. to 1 oz.).

Comedones or blackheads may be removed by pressure made over them with a small instrument constructed for the purpose. The accompanying acne requires attention, for which Sutton [8] recommends attention to diet, administration of nux vomica and gentian, and the local application of: Zinci Sulphatis, gr. 30 ; Sulphuris Precipitatæ, Potassæ Sulphuratæ, āā ʒj ; Aquam, ad ℥iv, night and morning, on cotton-wool swabs till exfoliation is produced, when it is replaced by rose-water ointment as a sedative.

Lupus should be treated by the Finsen light or X-rays, exuberant granulations being first of all removed under an anæsthetic. Recently, however, Sir A. E. Wright has advised the inoculation method of treatment.

Perichondritis.—If of a spontaneous nature the auricle should be dusted with fine boric acid, and then protected with a dressing of gauze and wool, or liquor plumbi subacetatis dilutus may be applied. Ice compresses also are recommended. Should syphilis or tuberculosis be present, the appropriate treatment for these conditions must be employed in addition to the above. If the inflammation is due to pyogenic infection, energetic treatment is necessary, the swelling must be incised, and all diseased tissue removed with a curette; the wound should be sponged out with 1 in 40 carbolic acid, dried and dusted with formidine, and then lightly packed with gauze, a dry dressing being finally bandaged on.

Phlegmonous Dermatitis, resulting from infectious diseases such as typhoid fever, can be treated with ice compresses, but when fluctuation appears the auricle must be incised and packed with strips of iodoform gauze, tonics are to be administered, and probably a hypodermic injection of $\frac{1}{6}$ gr. of morphia will be necessary to relieve the pain.

Noma Auris usually terminates fatally; the patient requires very careful nursing, plenty of nourishment, and frequent administration of stimulants; locally the diseased parts should be removed and antiseptic lotions freely used.

Abscess in Lobule, if of large size, such as results from suppuration taking place in a pre-existing cyst, should be incised and fomented; but if of small size, such as results from piercing the ear with a dirty needle, fomenting alone will usually suffice.

MALFORMATIONS OF THE MEATUS.

Congenital Atresia is most difficult to deal with, and is nearly always inoperable, as the middle, and even the inner, ear is frequently undeveloped, therefore the functional state of the ear must be investigated prior to treatment being attempted; this consists in throwing forward the auricle and then endeavouring to form a new passage through the bone into the tympanum with a dental drill. Unfortunately the new meatus is very likely to become occluded by contraction of its newly-made walls.

Ruttin [9] reports a case in which there was congenital deformity of both auricles with complete atresia of the meatus, and in which the patient could not hear a call or shout, yet the day after a meatus was formed by operation the patient could hear a shout at a distance of 7 mètres.

Congenital Webs should be removed by dividing their attachment at the meatal wall, then plugging the meatus for a few days, after which a piece of rubber tubing is inserted. This must be worn for some months, but of course must be removed for cleansing purposes at frequent intervals.

Stenosis usually re-occurs on cessation of treatment, which consists in a process of slow dilatation. Should the lumen be very small it is advisable to commence the dilatation of the membranous stricture by insertion of tents, followed later by a fine piece of rubber or lead tubing; when this has become loose it is replaced by a larger sized piece, which fits the meatus tightly; and when this has worn loose it in its turn is replaced by a larger piece, and so on.

NEW GROWTHS OF THE MEATUS.

New growths in the meatus are generally of a polypoid nature, and extend into it from the tympanum. They may be either innocent or malignant.

The innocent, usually **granulations or fibroid polypi,** are removed with an aural snare, care being taken to slip the wire well up to the base of the polypus, after the meatus has been well anæsthetised with a 6 per cent. solution of cocaine. Small and sessile granulations should be cauterised with chromic acid, a little being fused on the end of a probe for the purpose.

Malignant growths[10] require an extensive operation. The auricle is turned down and protected with warm cloths wrung out of saline, the diseased tissue, together with the affected part of the meatus, temporal bone and neighbouring fascia and glands is removed, the auricle being finally replaced and the wound closed. Skin grafting is employed if necessary.

Exostoses, if giving rise to no inconvenience or symptoms, may be left alone. Should, however, they so occlude the meatus as to produce pain, cause deafness, or in a case of otitis media purulenta prevent the free drainage of pus, surgical treatment must be adopted. In the former case an attempt may be made to restore the lumen of the meatus; the ear is deflected forwards by an incision behind the pinna, thus giving easy access to the growth; if pedunculated, it is removed by a chisel, care being taken to prevent injury to the middle ear through the chisel slipping by placing some plugging between the growth and the tympanic membrane. If sessile, the growth must be attacked by a dental burr, similar precautions against injury to the tympanic membrane being adopted if possible, but frequently, owing to the contracted state of the lumen, it will be impossible to insert any protective plugging; in these cases injury can only be prevented by the exercise of great care and skill on the part of the operator. In either case, after removal of the growth, the meatus must be well packed for a few days, and then the packing replaced by a piece of leaden tubing. Should, however, otitis media purulenta be present, a complete radical mastoid operation is to be performed, in order to give free drainage and at the same time remove as much diseased tissue as possible.

Papillomata should be removed with a scalpel and then the base cauterised to prevent recurrence.

DISEASES OF THE MEATUS.

General Diseases.—*Syphilis.*—Local manifestations of this disease should be treated with lotio hydrargyri nigra, general treatment being at the same time carried out.

Diphtheria.—The meatus should be frequently irrigated with a 20 per cent. solution of lactic acid; in the intervals alcoholic drops (*vide* Otomycosis) should be instilled, or ear baths of lime-water may be employed, followed by the insufflation of boric and salicylic acids in equal quantities. General treatment, together with injections of anti-diphtheritic serum, must of course be carried out simultaneously.

Croupous Otitis Externa.—The membrane should be removed and the meatus then insufflated with formidine or vioform.

Otalgia may be due to cerumen or a foreign body in the meatus, pressing on the tympanic membrane; the removal of the foreign body will at once cause cessation of the pain. Frequently it is due to a carious tooth, attention to which will lead to a similar beneficial result.

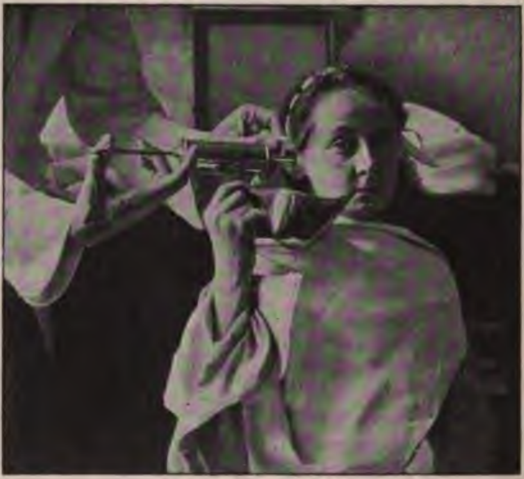


FIG. 5.

Neuroses, such as cough, tinnitus and vertigo, may sometimes be cured by the removal of a foreign body or of cerumen from the meatus.

Erysipelas, Telephone Ear (*see* Diseases of the Auricle).

Skin Diseases.—*Hypersecretion of Cerumen.*—It is usually when the meatus has become completely occluded with "impacted cerumen," that advice is sought for the resulting deafness. This is to be removed by syringing with lukewarm water; probes and scoopes are unnecessary and are liable to cause injury. The patient is seated on a chair, a piece of mackintosh is placed over the shoulder and close to the neck for purposes of protection, then a receptacle is held close under the ear in the manner shown in the illustration (Fig. 5). A 4 to 6-oz. metal ear syringe is used, the nozzle of which is directed along the posterior and superior meatal wall, so that the stream does not impinge directly on the cerumen, the pinna being grasped by the fingers of the left hand, and gently pulled upwards and backwards to straighten the meatus during the procedure. The meatus is examined from time to time to ascertain when all the cerumen has been removed; on this being accomplished, the meatus is gently dried, and then a small piece of wool is inserted, to be removed at bedtime and not reintroduced. Sometimes the cerumen is so hard and firmly impacted that syringing in this manner will not remove it. In these cases the cerumen must be softened by instilling alkaline drops in the ear for three or four days prior to syringing, when the removal can easily be effected. Those recommended by Lake[11] answer admirably, *e.g.*: Sodii Bicarbonatis, gr. 30; Glycerini, ʒij; Aquam, ad ℥j. Peroxide of hydrogen may be instilled, being kept in the meatus for fifteen to twenty minutes, and then the ear syringed.

Keratosis Obturans gives rise to the same difficulty of removal as very hard cerumen, and requires softening by alkaline drops prior to syringing. Yearsley[12] recommends the instillation of 2 per cent. solution of salicylic acid, followed by careful instrumental removal combined with syringing, and afterwards instillations of corrosive sublimate of a strength of $\frac{1}{500}$ to $\frac{1}{1000}$. In a case where syringing could not be tolerated, Bronner[13] obtained a satisfactory result by the instillation of enzymol drops (1 in 4) for fourteen days.

Deficient Secretion.—A mercurial ointment should be applied with gentle friction daily after the meatus has been thoroughly cleansed. Intense pruritus of the auditory canal, when no objective signs are present, is stated by Hunter Tod[14] to be due to deficient secretion.

Herpes.—Similar treatment to that described under Herpes of the Auricle should be employed.

Inflammations. — *Otitis Externa Circumscripta.* — Usually situated within the external orifice of the meatus, occasionally, however, the meatal aspect of the tragus is the site of the lesion; bathing with hot water and the instillation of morphia drops (℞. Morphinæ Hydrochloratis, gr. 2; Aquam Destillatam, ad ʒj) may relieve the pain. The following drops, used warm, are recommended by Hunter Tod[14]: Morphinæ Hydrochloratis, Cocainæ Hydrochloratis, Acidi Carbolici, āā gr. 2; Ol. Olivæ, ʒj; but incision through the apex of the furuncle with a very small scalpel, followed by the application of a fomentation to the ear, will usually effect a cure. The condition, however, is liable to recur. The application to the meatus of a 3 per cent. solution of acetate of aluminium has been advised.[5] Recently it has been recommended [15][16] that the condition be treated by the inoculation method, the vaccines being prepared on the lines laid down by Wright, the dose, according to Turton, being from 200 to 1,000 millions staphylocci.

Otitis Externa Diffusa.—If this is merely the extension of disease (*e.g.*, erysipelas or otitis media purulenta acuta) from a neighbouring locality, the treatment is included in that of the primary lesion. If, however, it is confined to the meatus, similar treatment to that described under Acute Eczema should be adopted. Good results have followed the application of glycerine of carbolic acid.[17] Children derive considerable benefit from the administration of cod-liver oil, and of rhubarb and soda powders occasionally: ℞. Pulveris Rhei, gr. 10; Sodii Bicarbonatis, gr. 10. Adults are benefited by the regular use of natural aperient waters, such as Apenta water.

Hæmorrhagic Otitis Externa. —The meatus is to be carefully mopped out with pledgets of wool, dipped in an alkaline solution if necessary, and then insufflated with a dusting powder, *e.g.*, vioform or xeroform, or, if much pain is present, with orthoform. At the same time the general health requires careful attention.

Acute Eczema.—If much exudation is taking place the meatus should be cleansed with an alkaline solution, *e.g.*: ℞. Sodii Bicarbonatis, gr. 7; Sodii Biboratis, gr. 7; Aquam, ad ℥j; then, after being carefully dried, it is dusted with dermatol or xeroform, or with equal parts of zinc oxide and starch. Liquor plumbi subacetatis dilutus applied alone is of great benefit in many cases, or a 10 per cent. aqueous solution of ichthyol may be applied.

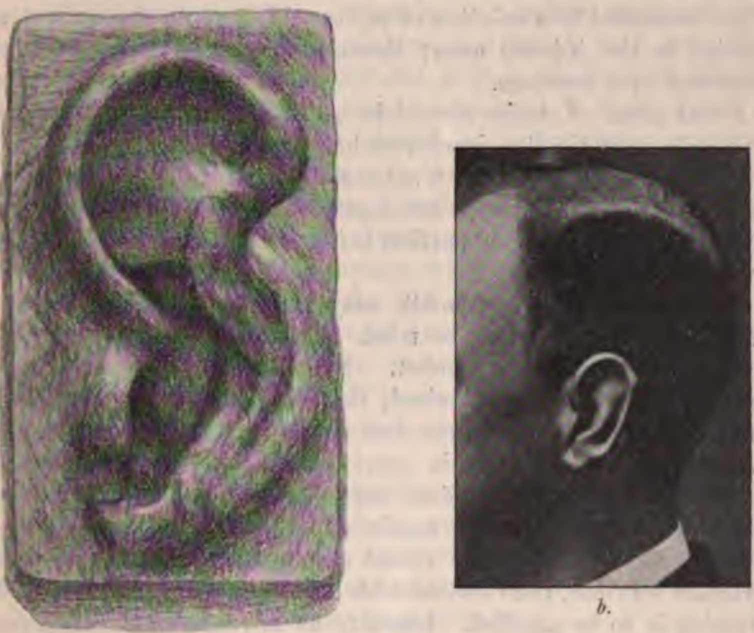
Chronic Eczema.—The treatment of the general condition is most important, such diatheses as gout requiring special attention. Locally any of the methods of treatment mentioned above may be tried, in addition, painting the meatus with: ℞. Argenti Nitratis, gr. 20; Aquam, ad ℥j; or applying Zinci et Hydrargyri Cyanidi, gr. 4½; Adipis Benzoati, ℥j. Peters' ointment also may be tried (*see* Chronic Eczema of the Auricle). If the meatus shows signs of contracting, a piece of tubing must be inserted to keep the passage patent.

Otomycosis.—The meatus must first be thoroughly cleansed with a 2 per cent. solution of formalin, then spirit drops should be instilled daily for from two to three weeks: ℞. Hydrargyri Perchloridi, gr. ¼; Aquæ ʒj; Spiritus Vini Rectificatus, ad ℥j. [U.S.P. ℞. Hydrargyri Chloridi Corrosivi, gr. ¼; Aquæ, ʒj; Alcohol, ad ℥j.] Grazzi[18] recommends as a prophylactic measure the closing of the meatus by cotton-wool before individuals expose themselves to grain dust, and, as a curative measure, washing the meatus with sterilised tepid water to which $\frac{1}{3}$ part of alcohol has been added, and then repeatedly introducing peroxide of hydrogen.

Lupus.—Herpes (*see* Diseases of the Auricle).

INJURIES.

Should the auricle be completely torn off, the wound must be cleansed, any bleeding vessels ligatured, and dry dressings applied, occlusion of the meatus during the healing process being prevented by the insertion of a piece of rubber tubing when necessary. Should the auricle be attached by even a slender piece of skin, the wound should be cleansed and the detached part carefully sutured back in its original position, dressings being applied. Should a portion be cut or torn out, ordinary surgical measures are to be adopted to promote healing. After the wound has completely healed an artificial auricle should be fitted and worn for cosmetic reasons; as mentioned above, excellent artificial ears are now being made.



a. *b.*

FIG. 6.

The accompanying illustration (Fig. 6) shows (*a*) a cast of an ear, a portion of which has been torn off in an accident, and (*b*) the individual concerned wearing an artificial ear made by H. Brook, of Halifax, Yorks.

An incised wound is to be sutured ; where there is a small loss of substance or in the case of a perforation, such as a bullet wound, an attempt may be made to correct the deformity by skin-grafting.

Injuries to the meatus do not require other treatment than syringing with an antiseptic lotion to keep the wound surgically clean.

Burns.—The affected area must be thoroughly cleansed, under a general anæsthetic if necessary, with a solution of saline, then strips of gauze soaked in a solution of picric acid (5 gr. to the ounce) are applied to the injured area; these are covered with wool and protected by a bandage.

Frost-bite.—Friction should be gently applied to the affected area with snow till the circulation has returned, then wool must be applied. Should, however, a sphacelus have formed, this should be dusted with iodoform, then some gauze applied underneath a wool dressing, the gangrenous portion being allowed to separate without artificial aid.

Hæmatoma, if very small, may become absorbed, therefore expectant treatment may be tried. The application of cold compresses has been recommended. But if of any size the swelling should be immediately incised, the clot turned out, the wound completely sutured, and then firm pressure applied by a bandage over the dressings. Sepsis must be carefully guarded against, for should the wound become septic necrosis of the auricle will probably result. Should sepsis supervene, the diseased tissue must be curetted away, the wound sponged out with 2 per cent. formalin solution, then dusted with formidine, after which a dry dressing is to be applied. Insanity as an occasional cause must be borne in mind.

FOREIGN BODIES.

Auricle.—Foreign bodies, such as pieces of wood or iron, which have penetrated the auricle and remained *in situ* must be removed and the wound thoroughly cleaned and dressed daily. It is not advisable to suture the wound, it being most unlikely that the foreign body was aseptic.

Meatus.—Insects, such as flies and earwigs, must first be killed by the instillation into the meatus of a few drops of chloroform, after which they are syringed out.

In adults, foreign bodies, such as pins, which lie in the meatus and do not come in contact with the whole of the meatal wall and so occlude the passage, may be removed by forceps, after thorough cocainisation, a good light reflected from a head-mirror being necessary. Should, however, the patient be restless and unable to remain still, it is advisable to administer an anæsthetic, otherwise the tympanic membrane may be injured during the attempts at removal.

In children, an anæsthetic is usually necessary. Such foreign bodies as beads and pieces of slate pencil can usually be removed by a syringe ; in using this method care must be taken to direct the stream along the meatal wall in an endeavour to bring the object out with the returning flow. Forceps are seldom necessary, and should only be used after syringing has failed, and then with extreme caution under an anæsthetic, as they are likely to slip over round objects, such as a boot button, and drive it more firmly in. Should these methods fail, or should an inflammatory condition have been set up, more or less occluding the meatus, the ear must be turned forward by a post-aural incision, and the foreign body removed through the larger aperture, obtained by dividing the fibrous meatal tissue longitudinally, when a fine instrument can be inserted beyond the foreign body, and so lift it out.

Some substances imbibe water and so increase their volume. The removal of such a foreign body by syringing should not be attempted unless the surgeon is prepared, in the event of failure, to operate during the same anæsthesia, otherwise untoward results may happen.

It is stated that vegetable substances, such as peas, which, having imbibed moisture, have swollen to such an extent as to prevent their removal readily by the syringe, may yet be so removed after instilling rectified spirits into the meatus for two or three days in order to cause shrinkage of the foreign body.

H. H. B. CUNNINGHAM.

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DISEASES AND AFFECTIONS OF THE TYMPANIC MEMBRANE.

MALFORMATIONS.

Congenital Absence of the tympanic membrane being always part of an arrested development of the external auditory canal and middle ear (Politzer[1]), does not admit of treatment.

Congenital Perforations in the membrane only require attention if much deafness is present; the treatment then consists in wearing of an artificial drum, provided this improves the hearing.

DISEASES.

Diseases of this membrane are frequently part of a middle ear affection; in such cases treatment must be directed to the graver lesion.

General Diseases.—*Herpes.*—In the early stages the vesicles should be painted with a little collodion; in the later stages some soothing application is advised, *e.g.:* ℞. Calaminæ, Zinci Oxidi Glycerini, āā ʒss; Liquor. Calcis, ad ℥j, general treatment being carried out at the same time. Yearsley[2] recommends the application of an ointment of extract of belladonna in vaseline, proportion 1 to 10.

Ecchymoses occurring during the course of a general disease, such as typhoid fever, scurvy, arterio-sclerosis, or even a severe fit of coughing, do not necessitate special local treatment, the physician's attention being necessarily directed to the general condition.

Local Diseases.—(1) INFLAMMATION.—*Acute Myringitis.*—First, to relieve the pain, a warm sedative solution may be instilled ℞. Tinctura Opii, ʒj; Aquam, ad ℥j and retained in the meatus for a few minutes, then a pledget of cotton-wool inserted after drying the meatus, or equal parts of olive oil and chloroform may be dropped into the meatus, or the drops recommended by Hunter Todd (*see* Diseases of the Meatus). Often v. Troltsch's method will suffice, *i.e.*, filling the meatus with warm water; this treatment must not, however, be continued for longer than fifteen minutes, otherwise the epithelium will become macerated.

Should the pain be very severe and the inflammation show no signs of decreasing, two leeches should be applied immediately in front of the tragus, the meatus being occluded by a piece of warm cotton-wool during their application; Brühl recommends rest in bed, removal of the secretion in the meatus by pledgets of wool, instillation of hot drops into the meatus, consisting of 10 per cent. solution of carbolic acid in glycerine, and the application of leeches in front of the tragus. Should an abscess form in the membrane it must be opened; great care is necessary in performing this little operation so that a perforation is not made through the membrane into the tympanum. The membrane being anæsthetised by Gray's solution (℞. Cocaine, gr. 10; Rectified Spirit, ♏10; Aniline Oil, ʒj), as recommended by Lake.[3] Inflation of the middle ear may be practised.

Chronic Myringitis.—In simple cases the meatus should be gently syringed out with 1 per cent. lysol or 2 per cent. izal solutions, and then equal parts of powdered boric acid and iodoform insufflated. Should, however, there be much suppuration, a solution of peroxide of hydrogen (strength 10 vols.) should be instilled into the meatus and allowed to remain there for five minutes prior to syringing, or[4] the secretion may be removed by pledgets of wool, the granulations touched with chromic acid, and then an alcoholic solution of perchloride of mercury instilled into the meatus.

(2) DEGENERATIONS AND SEQUÆLÆ.—*Atrophy* does not lend itself to treatment.

Calcareous Deposits usually occur during the course of middle ear disease, when treatment must be directed to that affection; if in a gouty subject, an anti-lithic treatment may be tried.

Adhesions are difficult to remove; intramuscular and intra-tympanic injections of fibro-lysin are recommended. The three above-mentioned conditions, however, are usually part of a middle ear disease; their treatment, therefore, is included in that of the middle ear.

Perforations in the active state, being due to a middle ear affection, that lesion must be the object of treatment; if the perforation is small and recent it will generally heal by the formation of scar tissue; as the middle ear affection subsides this can be aided by touching the edges of the perforation with chromic acid or silver nitrate occasionally; too frequent application will, however, destroy tissue instead of regenerating it. Large perforations do not heal and will remain permanently, on cessation of the causative inflammation.

As a variable amount of deafness always occurs in these cases, it is advisable to endeavour to combat this by the wearing of an artificial drum, provided this does not set up any irritation, does not prevent free discharge of secretion or pus, and actually does improve the hearing.

INJURIES.

Penetrating Wounds caused by sharp-pointed instruments, *e.g.*, tooth-picks, or needles, require careful cleansing of the meatus with an antiseptic lotion, such as ℞. Formolyptol 1 in 6 parts of water or Lysol, 2 per cent., and then insertion of a little wool in the meatus; these foreign bodies, as a rule, will have been withdrawn by the introducer. Should, however, a foreign body be found inserted into the tympanic membrane, the administration of an anæsthetic for its removal in the first instance is recommended, otherwise considerable injury may be caused in the attempt at removal, owing to pain during which the patient cannot be prevented from moving.

Probably in the case of injury by a fine-pointed instrument, and almost certainly when either the instrument is impacted in the membrane or the perforation has been caused by a blunt instrument, such as an ear-pick, suppuration will ensue. Treatment then must be directed to the otitis media.

Rupture.—(1) Affecting the tympanic membrane alone, as may occur from a blow on the ear, report of a gun, or too energetic inflation of the middle ear. When seen early the meatus should be gently cleansed with small pledgets of wool mounted on probes, and dipped in an aqueous solution of boric acid (10 gr. to 1 oz.) if moisture is necessary for the purpose, the meatus is then insufflated with xeroform and finally lightly packed with sterile gauze.

When not seen till after suppuration has commenced, the treatment for chronic purulent otitis media is indicated.

(2) Occurring in connection with fracture of the skull, treatment for the gross lesion is necessary, locally the meatus should be treated as above, and in addition if much pain or tinnitus is present, leeches or blisters should be applied to the mastoid process and sedatives administered.

H. H. B. CUNNINGHAM.

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[2] Yearsley, P. M., "Diseases of the Ear," Lond., 1897.
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ACUTE INFLAMMATION OF THE MIDDLE EAR.

BEFORE PERFORATION OF THE TYMPANIC MEMBRANE HAS TAKEN PLACE.

General Treatment.—The patient should be confined to his room, or even kept in bed, according to the severity of the attack. Light diet only should be taken. If there is much pain and pyrexia, a Dover's powder should be given at night, followed next morning by a smart saline purge. In addition, a simple diaphoretic mixture may be prescribed, and severe headache relieved by suitable doses of phenacetin or aspirin.

Local Treatment to the Ear.—This at first is palliative, the immediate indication being to relieve the pain. If the inflammation is mild and the pain not severe, frequent instillation (say every two hours) of a 5 to 10 per cent. solution of carbolic acid in glycerine may be sufficient. In more severe cases the following drops are recommended: ℞. Cocainæ, gr. 2; Morphinæ, gr. 1; Acid. Carbolici., gr. 3; Menthol., gr. 3; Ol. Amygd. Dulc. ʒj.

In addition, the side of the head may be covered with a thick pad of hot cotton-wool, on which some tincture of opium or chloroform has been sprinkled. In some cases the application of cold by means of pieces of ice between layers of cotton-wool or by an aural ice-bag not only relieves the symptoms, but tends to reduce the inflammation. This treatment, however, should not be continued for more than twenty-four hours unless it is obvious that it is doing good.

On the other hand, the ear should not be syringed; nor are hot fomentations advised, as they tend to increase the congestion. A middle course is to be preferred, namely, the application of warm compresses of boracic lint, covered with oilskin, and changed every two or three hours. If the progress of the inflammation is very rapid, and if the pain increases in severity, leeches may be applied in front and behind the ear in order to relieve the congestion, but as a rule paracentesis will be indicated.

If, on the other hand, the symptoms subside, local treatment should be diminished gradually, but the ear should be protected by means of a pad of cotton-wool for some days.

After all the acute symptoms have disappeared, that is, at least two days after the last trace of earache, gentle inflation of the middle ear by Politzer's method should be undertaken for two reasons: (1) To assist recovery by promoting absorption and removal of the exudate; and (2) to avoid possible adherence of the tympanic membrane to the inner wall of the middle ear, the result of which would be to prevent the complete restoration of hearing.

In addition to local treatment of the ear, attention should be directed to the nose and throat, and any existing nasal and post-nasal catarrh should be treated accordingly by means of sprays and inhalations. Unless absolutely necessary, a nasal douche should not be used during the acute stage, although in certain cases (for instance, in small children) gentle irrigation of the nasal passages to remove a purulent discharge may be called for.

Indications for Paracentesis. (Incision of the tympanic membrane).—This is indicated in the following conditions, provided palliative treatment, when possible, has been attempted for forty-eight hours, but each case must be judged on its own merits:

(1) If there is increasing pyrexia and pain, and the tympanic membrane shows marked congestion and bulging, especially in its upper posterior quadrant.

(2) If there is obvious presence of pus, shown by a circumscribed angry red or yellow protuberance of the tympanic membrane.

(3) If there is marked tenderness over the mastoid process.

(4) If the paroxysms of pain are so acute as to prevent sleep.

(5) If there are any cerebral symptoms, such as drowsiness, vomiting, vertigo, or convulsions.

In all cases of doubt it is wiser to perform paracentesis early than delay too long before doing so.

Technique of Paracentesis.—The auricle and auditory canal should be cleansed by syringing gently with a 1 in 20 solution of carbolic acid, or a 1 in 2,000 solution of bin-iodide of mercury. A general anæsthetic is to be preferred (nitrous oxide gas in the case of an adult, but chloroform or the A.C.E. mixture for a child) as the pain of paracentesis is extremely acute. If, however, this is refused by the patient, a few drops of Gray's solution (cocaine, gr. 12; aniline oil, ʒj; absolute alcohol, ʒj) may be instilled into the ear fifteen minutes before the operation. This solution, however, is seldom sufficient to anæsthetise the tympanic membrane. It is essential to obtain a clear view of the tympanic membrane, to do which the surgeon must work by reflected light. If a general anæsthetic has not been given, the patient's head should be supported firmly during the act of performing paracentesis in order that movement may be prevented. A free incision is made into the membrane with a small knife, shaped like a tiny bistoury, set at an angle to its handle. The incision should be made through the posterior part of the membrane, beginning low down and incising the drum freely in an upward direction midway between its circumference and the handle of the malleus (Fig. 1). The most common fault of the inexperienced is merely to puncture the membrane; this is of little value, as in most cases the wound heals too soon. If the acute inflammation is limited to the attic region, shown by bulging of Schrapnell's membrane, then it is only necessary to make an incision through the affected part. After the first rush of discharge and blood has been mopped away a small drain of sterilised gauze should be inserted into the auditory canal, and a pad of sterilised cotton-wool fixed over the ear.

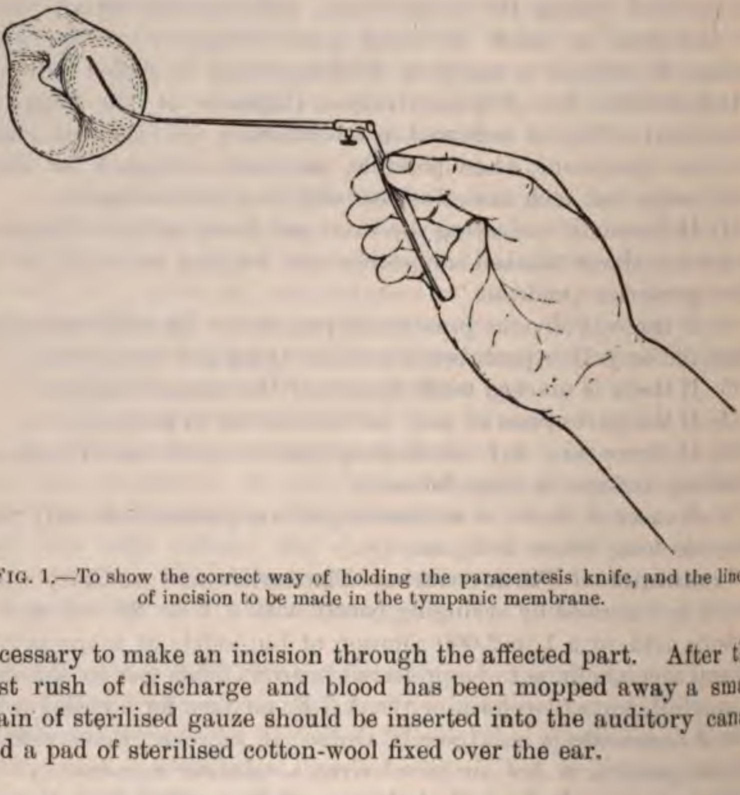

FIG. 1.—To show the correct way of holding the paracentesis knife, and the line of incision to be made in the tympanic membrane.

AFTER PERFORATION OF THE TYMPANIC MEMBRANE HAS TAKEN PLACE (MIDDLE-EAR SUPPURATION).

The principles of treatment are free drainage and asepsis. The continuance of pain or pyrexia in a simple middle-ear suppuration is generally due to insufficient drainage. This may necessitate further incision of the membrane. Insufflation of powders is contra-indicated, because they may prevent the outflow of the discharge. If the purulent discharge is profuse and thick, the ear should be syringed with a warm 1 per cent. solution of lysol. If the auditory canal is obstructed by macerated epithelium or inspissated pus, it should be filled with a warm solution of hydrogen peroxide, which should be left in the ear for at least fifteen minutes before syringing. If the perforation is at the apex of a nipple-shaped projection, the projecting part should be snared off.

After the ear has been cleansed it should be dried with small pledgets of sterilised wool, and a narrow strip of gauze should be inserted into the auditory canal to act as a drain. For the first few days this treatment may have to be repeated several times during the twenty-four hours, but should be given less frequently as the discharge lessens.

It is of importance that the auricle and surrounding parts should be kept surgically clean, in order, if possible, to prevent further infection from without, as it is now recognised that a mixed infection is one of the principal factors in producing chronic middle-ear suppuration. In certain cases in which attacks of earache still continue in spite of free incision of the membrane having been performed (and this is more especially the case in attic suppuration), much relief may be obtained by the use of Seigle's pneumatic speculum as a suction apparatus in order to suck out the secretion from the middle ear through the perforation. After the discharge has ceased and the perforation has healed, inflation of the middle ear should be practised in the manner already described.

AÇUTE SUPPURATION OF THE ANTRUM AND MASTOID CELLS.

This is not an infrequent complication, and when diagnosed necessitates surgical interference. It must, however, be remembered that in many cases of uncomplicated middle-ear suppuration there may be pain and tenderness over the tip of the mastoid process, due to congestion of the mucous membrane lining the mastoid cells, and not necessarily to actual suppuration.

If paracentesis of the tympanic membrane has not already been performed, it should be done at once, and further operative interference delayed for twenty-four hours to see if the symptoms subside.

Surgical treatment may consist of: (1) Wilde's incision or (2) Schwartze's operation (opening into the mastoid antrum and cells).

(*a*) **Wilde's Incision** consists in incising the tissues down to the bone by means of a post-aural incision. This is only justifiable in infants, as the pus may have escaped to the surface of the mastoid process, either through the still existing squamo-mastoid suture or along the posterior wall of the auditory canal between the bone and the periosteum, without there being any disease of the bone itself. In older children and in adults this operation is useless, as the mastoid abscess is then due to bone disease.

(*b*) **Opening of the Mastoid Antrum and Cells (Schwartze's Operation).**—The following are the indications: (i.) If, in spite of free drainage and careful conservative treatment, the earache, pyrexia and tenderness over the body of the mastoid process do not abate within two days. (ii.) If there is an obvious abscess over the mastoid process. (iii.) If, in spite of free drainage, there are symptoms of meningeal irritation. (iv.) If there is profuse otorrhœa, lasting for a period of four weeks, with sagging downwards of the upper posterior wall of the external meatus. (v.) If, in spite of conservative treatment, there is no sign of cessation of the otorrhœa after eight weeks. In this latter condition the continuance of the discharge is almost certainly due to accumulation of pus within a large antral cavity, and the object of the operation is to permit of free drainage, which otherwise will not take place.

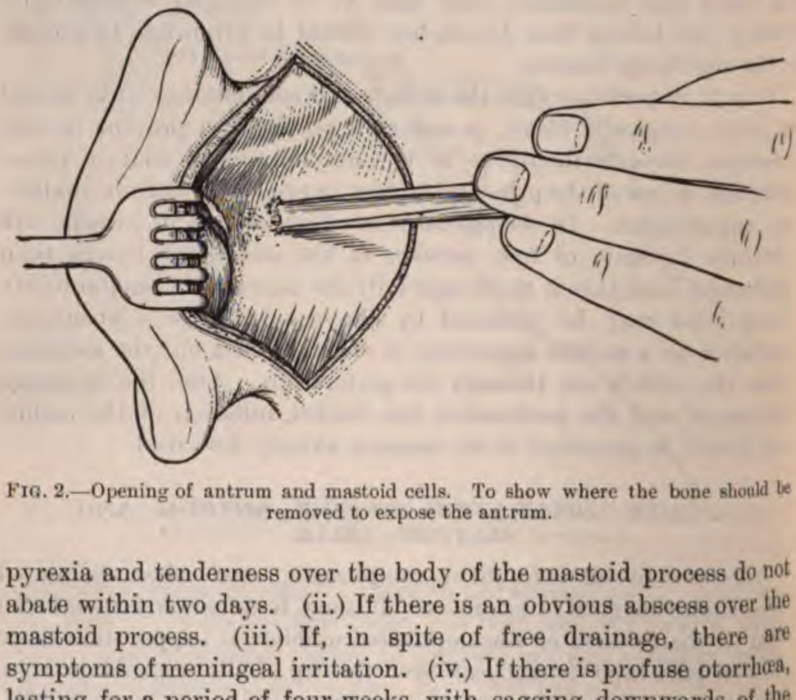

FIG. 2.—Opening of antrum and mastoid cells. To show where the bone should be removed to expose the antrum.

Technique of the Operation.—The head should be shaved for a space of 2 or 3 inches around the mastoid region (if possible twenty-four hours before the operation) and the parts thoroughly cleansed, and afterwards protected with a compress of a 1 in 2,000 solution of biniodide of mercury. A general anæsthetic is essential. A curved incision is made down to the bone, beginning just behind the upper insertion of the pinna and extending downwards about ½ inch behind the auricle towards the tip of the mastoid process. If a mastoid abscess is present, the pus is allowed to drain away and the cavity irrigated with a solution of biniodide of mercury. The soft tissues are reflected forwards and backwards with a periosteal elevator until the posterior upper margin of the bony meatus and Henle's spine in front, the zygomatic ridge above, and the fibres of the sterno-mastoid below, are brought into view. The fibrous portion of the external auditory canal should not be separated from the bony meatus. After arresting all bleeding points the bone should be examined carefully for a fistula, which, if present,

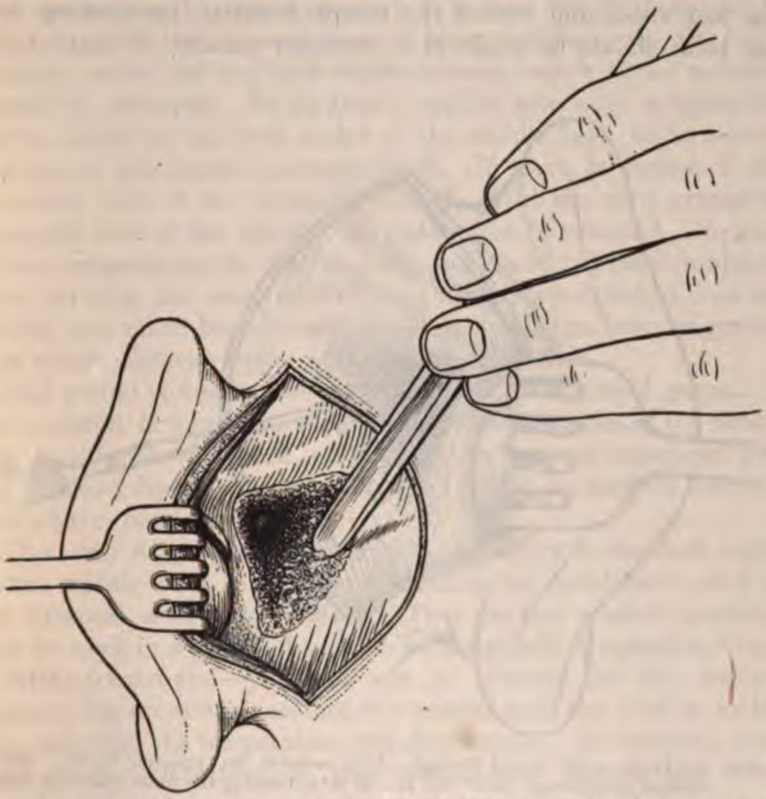

FIG. 3.—Opening of antrum and mastoid cells. To show extent of removal of bone at completion of operation.

is usually situated over the body of the mastoid, close behind the external auditory meatus. The approximate surface-marking of the position of the antrum is the supra-meatal triangle, but this, however, is an uncertain guide. The area of bone to be removed is about ½ inch square, having as its boundaries Henle's spine in front and the zygomatic ridge above (Fig. 2). As the antrum lies just above and behind the tympanic cavity, the opening into the bone should be made in a direction parallel to that of the auditory canal. The bone should be removed in such a manner that a funnel-shaped opening is made, having its apex directed inwards, upwards and forwards towards the aditus (Fig. 3). Anteriorly, the bone should be removed as close as possible to the posterior wall of the auditory canal, which, however, should not be opened into. If the bone is carious and granulations are present, they should be curetted away gently. If a fistula exists, careful probing may prove that it leads into the antrum, and the probe, if necessary, may be used as a guide. On opening into the antrum, pus will be seen to exude, and the probe can be felt to pass

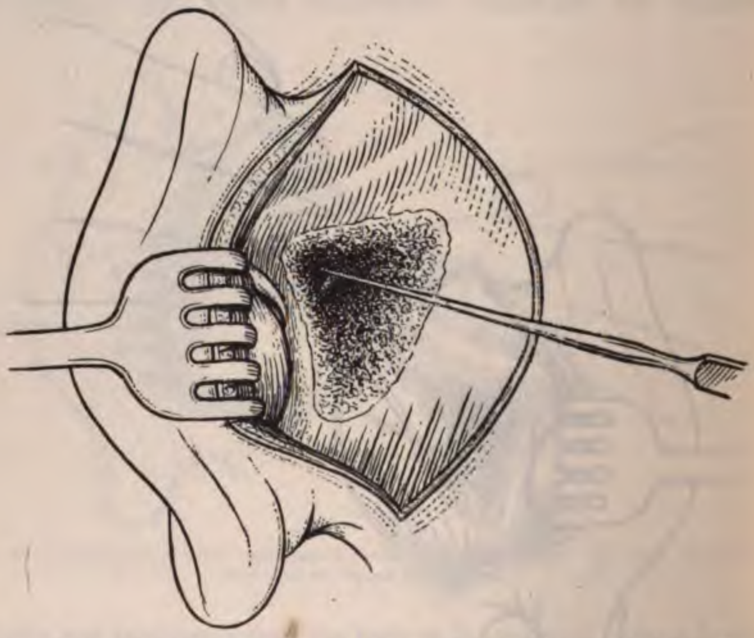

FIG. 4.—Probe being passed through aditus towards the tympanic cavity. The external semicircular canal can just be seen, forming the inner wall and floor of the aditus.

into a cavity. The antrum can be recognised as a smooth surface, which has quite a different appearance to the mastoid proper. Careful search should be made for the aditus, which can be recognised as a small hole in the anterior inner part of the antrum, on the floor of which may be seen the whitish rounded eminence of the external semi-circular canal. For the sake of confirmation a bent probe may be passed through it towards the tympanic cavity (Fig. 4). All the diseased area of bone, together with any overhanging edges and any cells which communicate with the antrum, should be removed. To do this it may be necessary to expose the lateral sinus or the dura mater of the middle fossa, or to remove the tip of the mastoid process itself. If there is disease of the posterior wall of the external meatus, or of the cells extending along the roof of the zygoma, they also must be removed. So long as the tympanic cavity itself is not injured, and the small bridge of bone forming the outer wall of the aditus is left intact, it does not matter how much bone is removed, even if this involves the greater part of the posterior upper wall of the bony meatus.

The wound is finally dried and plugged with sterilised gauze. If the incision is large, the upper and lower extremities of the wound may be sutured. If there is a deep cervical abscess associated with the mastoid disease, a counter-opening should be made in the neck and a tube inserted.

The *chief dangers* of the operation are injury to the dura mater of the middle fossa, to the lateral sinus, to the facial nerve, and to the external semi-circular canal. They are best avoided by taking care to work in a good light and to keep the field of operation dry.

After-treatment.—If there was no abscess of the mastoid process, the dressings need not be changed until the third or fourth day, provided the temperature remains normal. If, however, there was much infiltration of the surrounding tissues, the outer dressing should be changed the next day and a light dressing of wet boracic lint applied, and changed frequently. At each dressing the cavity should be thoroughly cleansed with a weak solution of biniodide of mercury, the wound dried and re-packed. The wound gradually closes by cicatrisation.

If the operation has been successful, the discharge from the ear usually ceases within two or three days, and the antrum soon becomes separated from the tympanic cavity by granulation tissue. Healing of the wound should take place within four to eight weeks. The hearing becomes normal even before this date. The results of the operation are good. An unfavourable sign is continuance of the discharge, which is usually due to disease of the attic region.

Non-healing of the wound posteriorly means that all the diseased bone has not been removed, and if a fistula persists the wound must be opened up and any underlying bone disease removed. A fistula behind the ear, together with continuance of the discharge from the meatus, is an indication for the complete mastoid operation.

ACUTE INFLAMMATION OF THE MIDDLE EAR SECONDARY TO INFECTIOUS DISEASES.

The principles of treatment are the same as already described in non-infectious cases, but owing to the fact that the general condition of the patient frequently is grave, the ear symptoms may be masked, unless a daily examination is made.

In **measles** a middle-ear catarrh may occur soon after the appearance of the rash, but usually subsides without suppuration taking place. No special treatment is required, except the frequent instillation into the ear of a few drops of a 10 per cent. solution of carbolic acid and glycerine. Acute middle-ear suppuration may occur about the third week, but if the patient is under observation a free paracentesis should be performed before this has been allowed to occur.

In **scarlet fever** a very acute destructive form of middle-ear suppuration may occur in the early days of the disease, and may rapidly extend and involve the mastoid process. This is especially prone to occur if, in addition to scarlet fever, a diphtheritic infection is also present. It is of the greatest importance to perform a paracentesis as early as possible, and then to syringe out the ears gently every two or three hours with a warm 1 in 5,000 solution of biniodide of mercury. If the mastoid itself becomes involved, opening into the mastoid cells and antrum may be necessary. It has recently been advised that the complete mastoid operation should be performed in these cases rather than the simple operation. My opinion is that each case must be treated on its merits, and that the extent of the operation must depend on what is actually found at the time of the operation itself.

In **diphtheritic cases**, in addition to the usual ordinary treatment of the ear, injections of anti-diphtheritic serum should be given.

In **typhoid fever** acute middle-ear inflammation or suppuration not uncommonly occurs about the fourth or fifth week of the disease. A routine examination of the ears is very essential in these cases owing to the apathetic condition of the patient.

In all infectious diseases, any inflammatory affection of the throat should be treated as thoroughly as possible, and repeated cleansing of the throat and naso-pharynx should be carried out, as the condition of the patient is often such that he cannot do it for himself.

HUNTER TOD.

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CHRONIC SUPPURATIVE INFLAMMATION OF THE MIDDLE EAR.

Chronic suppurative inflammation of the mucosa lining the middle ear cleft (the Eustachian tube, the cavum tympani, and mastoid antrum) is in almost all cases the result of previous acute disease. Certain local conditions predispose to chronicity, such as inadequate drainage from either a too small or a too highly situated perforation of the membrana tympani, tufts of exuberant granulation tissue, or intra-tympanic adhesions, which shut off pus-containing loculi. To determine exactly when a case may be regarded as chronic is somewhat difficult, and depends not so much upon lapse of time as upon the type and character of the organic changes which have taken place, and to a certain extent also upon the cytological findings in a droplet of discharge taken from the interior of the middle ear.

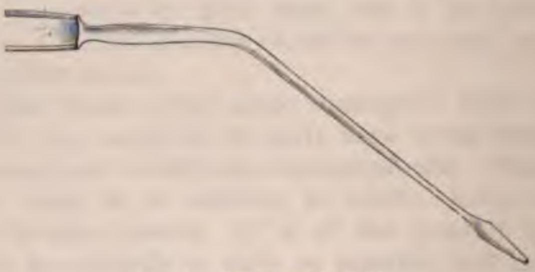

Fig. 1.—Paracentesis knife.

Tuberculous otitis media, however, runs an almost chronic course from its very commencement and is characterised by its painless and asthenic course, by the presence of one or more perforations, by the almost invariable and very early appearance of facial paralysis, and by enlargement of the peri-auricular glands. In cases of diabetic and influenzal origin the acute phase of the disease may be a very short one. Every case of chronic purulent inflammation of the middle ear calls for active treatment, not only on account of the damage to the delicate mechanism of audition brought about by neglect of treatment, but also on account of the danger of septic invasion of contiguous structures, *e.g.*, the lateral sinus, the dura mater, the cerebral and the cerebellar lobes.

The main essentials in treatment are: (1) The provision of free and unimpeded drainage; (2) the maintenance of surgical cleanliness; (3) the application of the ordinary principles of antiseptic surgery. It should be noted at the outset that the principles underlying the successful treatment of any case of chronic suppurative otitis media are the same as those which govern the treatment of suppuration elsewhere in the body, due regard being paid to the anatomical peculiarities of the special region involved.

The existing perforation is frequently found to be quite inadequate or too highly situated upon the surface of the membrane to effect true surgical drainage. Under such circumstances it should be freely incised and an endeavour made to keep it open by re-incision if necessary. In children and nervous subjects incision should be made under the influence of a general anæsthetic, *e.g.*, nitrous oxide and oxygen, or ethyl-chloride. In adults the local application of Gray's solution (cocaine hydrochloride 2 parts, aniline oil 10 parts, and absolute alcohol 10 parts) usually proves sufficient. The knife used (Fig. 1) should have a very keen edge and may or may not be, according to the fancy of the operator, provided with a collar (Fig. 2). Tufts of exuberant granulation tissue or polypi should be removed, not only to secure free drainage, but also to permit of the local application of medicaments to the interior of the tympanic cavity. The patency of the Eustachian tube should also be maintained to allow of drainage and to secure ventilation of the middle ear.

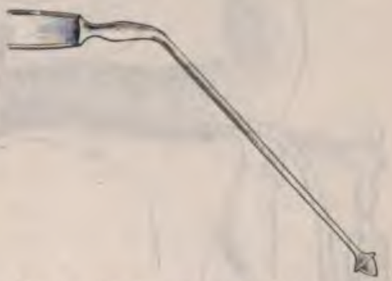

FIG. 2.—Paracentesis knife with collar.

The following routine for efficiently cleansing the infected middle ear tract will be found of service: (1) Inflation of the middle ear with the air douche or by means of the Eustachian catheter (provided that the perforation, if very small, has been *freely* incised); (2) syringing the external meatus with a warm antiseptic solution or warm sterilised water; (3) aspiration of the middle ear by means of a Siegle's speculum or Sondermann's suction apparatus; (4) re-inflation; (5) syringing again and drying the meatus with a strip of antiseptic gauze or pledget of sterile wool.

In those cases where the perforation is situated in Shrapnell's membrane and where the epitympanic recess is the main site of disease syringing should be conducted with Hartmann's or the writer's intra-tympanic syringe (Fig. 3), the point of the instrument being passed under illumination through the perforation and into the "attic."

The middle ear having been cleansed, one or other of the following methods of treatment may be adopted: (*a*) The instillation of fluid remedies, antiseptics, sedatives, astringents; (*b*) the insufflation of finely pulverised powders; (*c*) the aspiration of the contents of the middle ear by tampons of gauze.

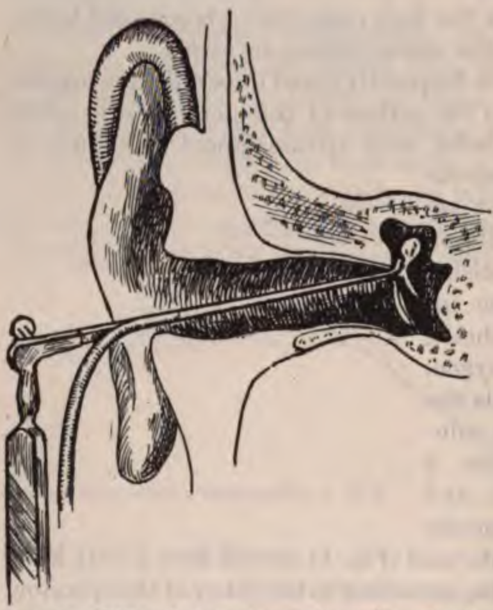

FIG. 3.—Milligan's intra-tympanic syringe *in situ*. (From Milligan and Wingrave's Diseases of the Ear, Macmillan.)

A decision as to which plan of treatment to adopt should be determined by the amount and character of the discharge, by the presence or absence of caries or necrosis, and by the ability or otherwise of the patient to attend regularly and frequently for treatment.

When the discharge is profuse and when the patient can only be seen from time to time, treatment by means of lotions is to be preferred. The particular lotion selected should, after cleansing, be warmed and poured into the meatus until it is quite full. It should be allowed to remain *in situ* for from five to ten minutes and should be used two or three times a day according to the amount of discharge present. Such solutions as glycerine of carbolic acid (2 to 4 per cent.), resorcin (6 gr. to 1 oz.), sulphate of copper (6 gr. to 1 oz.), sulphocarbolate of zinc or soda (6 gr. to 1 oz.), nitrate of silver (5 to 20 gr. to 1 oz.), boracic acid (10 to 20 gr. to 1 oz.), perchloride of mercury (1 in 2,000), peroxide of hydrogen (3 per cent.), or a combination of one or more of the above-named drugs, according to the character of discharge present, will be found serviceable. Care should always be taken that the drugs employed are not too irritating to the tissues, while a change of lotion during the course of treatment is often beneficial.

If when the lotion is *in situ* the patient performs a negative Valsalva, *i.e.*, swallows with his mouth and nose closed, the entrance of the medicament into the cavum tympani is facilitated.

Following the application of the lotion, the ear should be dried and packed with a strip of gauze or pledget of antiseptic wool. It is advisable, especially in the case of children, to bind an antiseptic dressing over the external ear.

When the drainage from the middle ear is free, when the discharge is not profuse, and when the patient is under observation, dry treatment by the insufflation of antiseptic powders will be found satisfactory.

Such powders as finely pulverised boracic acid, aristol, dermatol, europhen, iodol, iodoform or iodoform and boracic acid (1 to 4) are serviceable. Before insufflation the meatus should be thoroughly dried. The insufflation should be repeated every third or fourth day according to the frequency with which the powder becomes soaked through.

Treatment by insufflation is contra-indicated if the perforation is small, if acute inflammation is present, and in young children.

Aspiration by means of gauze tampons may be advantageously employed where the amount of discharge is not very great and when it is possible to change the dressings frequently. A strip of sterilised white, double cyanide, or iodoform gauze is packed loosely and evenly upon the perforated membrane and a pad of gauze fixed over the ear. The dressing is changed as frequently as it gets soiled. In many cases this method is useful, but is contra-indicated in acute disease, in very young children, and when a diffuse otitis externa is present.

During the treatment of a case of chronic suppurative otitis media resort should frequently be had to Politzerisation, not only for the purpose of forcing any residual secretion from the cavity of the middle ear, but also in order to minimise the effect of interossicular adhesions.

The success of any given line of treatment is gauged by the decrease in the amount of discharge, by an improved hearing capacity, and by the gradual cicatrisation of the perforation.

In many chronic cases the tympanic mucous membrane becomes granular, and at times, more especially when bone disease is present, polypoid granulations form which tend to impede drainage and to retard recovery.

Granulations.—These vary in size, being at times quite minute, at other times the size of a small pea. They may arise from any part of the tympanic mucosa or from the edges or surface of the perforated membrane. If small they should be cauterised with chromic acid, sesquichloride of iron, trichloracetic acid, or with a fine galvano-cautery point.

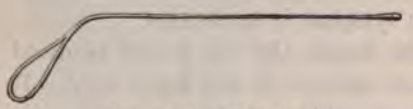

FIG. 4.—Aural probe.

The application of chromic acid may be effected by fusing a crystal upon a delicate aural probe (Fig. 4), or by tipping the probe with cotton-wool and dipping it into a solution of the acid (2 drachms to 1 oz.). Should severe pain ensue it may be at once relieved by syringing with warm saturated solution of bicarbonate of soda, followed by the instillation of cocaine drops (5 to 10 per cent.).

Somewhat larger granulations may be removed with Hartmann's forceps (Fig. 5), or by gentle curetting. Curetting of the tympanic mucosa through the meatus should, however, be performed with the greatest possible care for fear of injuring such important structures as the stapedio-vestibular articulation, the Fallopian aqueduct and the roof of the middle ear, which in cases of chronic suppurative otitis media is occasionally perforated and through which tufts of granulation tissue springing from an exposed dura mater at times protrude. Many fatal accidents have followed indiscreet intrameatal manipulations.

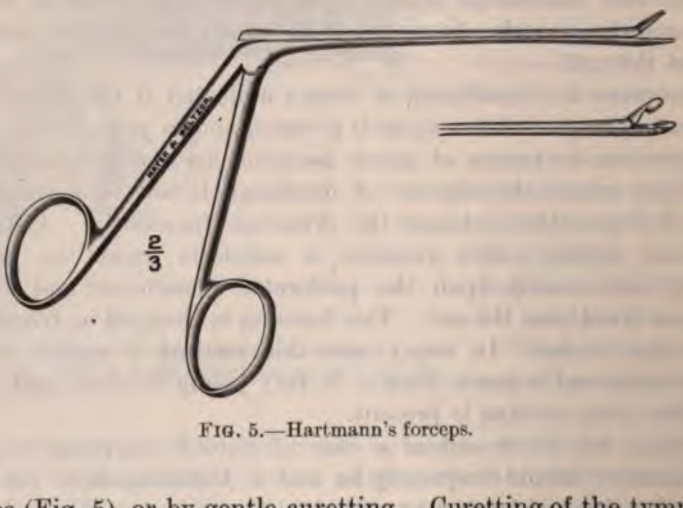

FIG. 5.—Hartmann's forceps.

Cauterisation.—The tympanic mucosa is first of all rendered anæsthetic by the application of cocaine-adrenalin solution or by Neumann's infiltration anæsthesia (p. 913), and then thoroughly dried, otherwise steam generated by the application of the cautery point to the moist tissues is prone to scald.

A fine cautery point is selected and passed through a speculum (using as large a speculum as possible) until it is in contact with the granulation.

The circuit is then at once completed and the point, at a white heat, pressed into the substance of the granulation.

It is important not to turn off the current until the point has been withdrawn from contact with the granulation, as if allowed to cool down it is prone to adhere to the tissues, and on removal to cause troublesome bleeding.

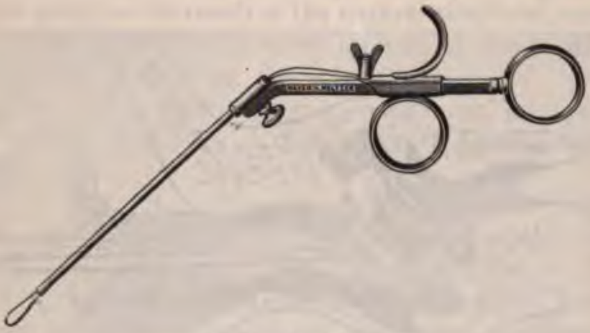

FIG. 6.—Aural snare.

Should pain be complained of the meatus should be syringed with warm sterile salt solution and subsequently filled with a warm 2 per cent. solution of cocaine hydrochloride. Subsequently it should be dried and packed loosely with a strip of gauze.

Aural Polypi.—These should invariably be removed: (1) Because they are the outcome of a deeper seated morbid process; and (2) because they tend to impede drainage.

They may be removed by: (1) Syringing; (2) the use of alcohol drops; (3) the repeated application of caustics; (4) the injection of an alcoholic solution of formalin; and (5) by the use of snares, curettes, ring knives or forceps.

Syringing can hardly be seriously considered as a method of treatment. If, however, the polypus possesses a long and thin pedicle the act of syringing, especially if somewhat forcibly performed, may detach the growth or may so twist its pedicle as to cause its subsequent sloughing.

The frequent instillation of alcohol drops or the injection of an alcoholic solution of formalin into the substance of the growth may in the case of small polypi cause a gradual shrivelling up.

The repeated application of chemical caustics, *e.g.*, chromic or trichloracetic acid, is useful in the case of small and œdematous polypi. The insertion of a fine galvano-cautery point into the substance of the growth is efficacious, but is fraught with very considerable danger except in expert hands. The most reliable and efficient method is removal by means of the cold wire snare, either by *avulsion* or by *excision*.

Previous to the removal of the growth the auricle and the external auditory meatus should be thoroughly cleansed with peroxide of hydrogen drops (3 per cent.) and syringed with a warm 1 in 2,000 solution of perchloride of mercury.

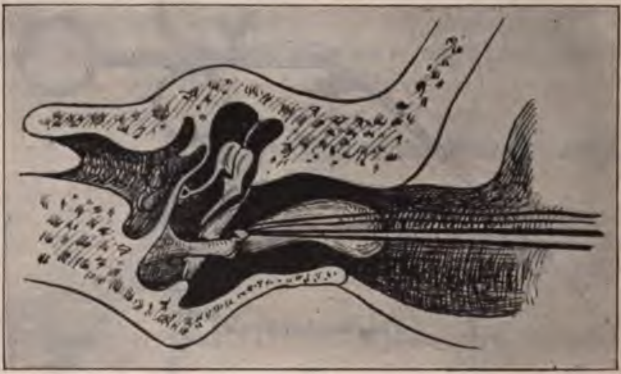

FIG. 7.—Removal of polypus. Loop of snare in position (semi-diagrammatic). (From Milligan and Wingrave's Diseases of the Ear, Macmillan.)

If possible the actual site of attachment of the growth should be determined beforehand by inspection or by palpation with a probe.

The wire loop (soft malleable iron wire) of the snare (Fig. 6), drawn out to such a size as readily to encircle the growth and bent slightly downwards, is passed through a speculum under good illumination over the polypus and gently insinuated as near to its point of attachment as possible and is then gradually tightened (Fig. 7). The growth is then either forcibly avulsed or cut through cleanly, much depending upon its consistence. On withdrawing the snare the polypus is usually found within its grasp, if not it may be removed by syringing or with a pair of forceps. As a rule, there is fairly free hæmorrhage, which is easily controlled by syringing with hot sterilised water or by packing the meatus with gauze. After all hæmorrhage has ceased the attachment of the growth should be inspected, and, if necessary, further portions removed with Hartmann's forceps. The meatus should again be cleansed and packed with gauze, a suitable dressing being finally placed over the external ear.

After treatment.—At the end of from twenty-four to thirty-six hours the dressing should be removed and the ear syringed. The attachment of the growth (its so-called root) should now be touched with chromic or trichloracetic acid or with a fine galvano-cautery point, the idea being gradually to obtain eradication of the whole of the growth within the tympanum partly by the application of caustics and partly as the result of the natural cicatricial contraction of tissue. This contraction is much assisted by the instillation of alcohol drops (Spt. Vini. Rect., 4 drachms to 1 oz.).

Avulsion by means of forceps (*e.g.*, Wingrave's) is now seldom practised on account of the risk of injuring the delicate mechanism of the middle ear.

So long as any discharge is present there is a liability to recurrence; hence antiseptic treatment should be continued until all traces of suppuration have disappeared.

Polypoid granulation tissue springing from carious foci within the tympanic cavity is frequently met with in old-standing cases of suppurative otitis media. Such carious foci may be quite minute or may involve considerable areas. Under illumination they may be carefully scraped with a curette. Permeatal curetting should be performed with the greatest care and, speaking generally, is an unsatisfactory and dangerous process. Sequestra, the result of necrosis, often buried in vascular granulation tissue, are common in tuberculous otitis media and in cases due to gonococcus infection.

The outer attic wall, portions of the semicircular canals, the pars promontoria, and the cochlea occasionally sequestrate. The ossicula auditus, the malleus and incus, more frequently the latter, at times become carious, while their presence tends to maintain suppuration. The stapes, from the fact that it receives a double blood supply, tympanic and labyrinthine, is much less frequently the seat of disease. Caries of its footplate is generally regarded as pathognomonic of a tuberculous process.

Removal of the ossicula auditus is more especially called for in cases of epitympanic suppuration with perforation of Shrapnell's membrane (p. 912), although it is at times a useful procedure in suppuration of the atrium when their presence impedes drainage and where local treatment has proved unsuccessful.

EPITYMPANIC SUPPURATION WITH PERFORATION OF THE MEMBRANA FLACCIDA SHRAPNELLI.

The epitympanic recess contains the head and neck of the malleus, the body of the incus, the stapes and their ligamentous attachments. The disposition of the ligaments is such as to divide the cavity into two compartments, an inner and an outer. The latter is divided into two spaces, an upper and a lower. The lower, or Prussak's space, is from the practical point of view the more important and is frequently the seat of suppuration ending in caries of the head of the malleus and the formation of tufts of granulation tissue. In cases of generalised tympanic suppuration the epitympanic recess becomes shut off at times from the tympanum proper by adhesions.

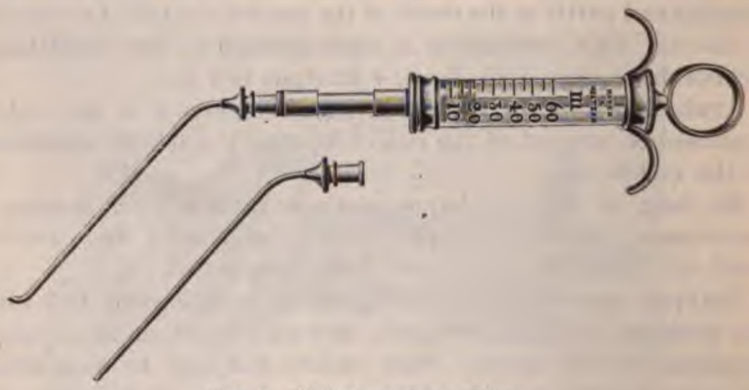

FIG. 8.—Blake's tympanic syringe.

From its comparative inaccessibility and from the position and size of the perforation in Shrapnell's membrane such cases are prone to be peculiarly intractable.

To cleanse the epitympanum it is necessary to use a special form of syringe (Hartmann, Milligan).

Under illumination the syringe is introduced into the "attic" and the cavity washed out until the washings contain no traces of pus or cholesteatomatous *débris*. With a Blake's intratympanic syringe (Fig. 8) the particular medicament to be employed is injected, *e.g.*, solutions of carbolic acid, peroxide of hydrogen, alcoholic solutions of salicylic acid (1 per cent.), or of perchloride of mercury (1 in 3,000).

In the majority of cases of chronic epitympanic suppuration it is necessary, however, to remove the ossicular chain and outer attic wall in order to obtain free drainage and free access to the infected area.

This operation for the removal of the malleus, incus and outer attic wall (ossiculectomy and atticotomy) has, as a rule, to be performed under a general anæsthetic, although it is possible in certain cases to obtain sufficient anæsthesia with Neumann's infiltration method.

A syringe with its needle fixed at an obtuse angle (Fig. 9) is filled with 1 c.c. of a solution of 1 in 2,000 adrenalin chloride containing 1 per cent. of β-eucaine. The auricle is pulled forwards, the needle plunged into the auriculo-mastoid groove, and the fluid injected between the anterior bony wall of the mastoid process and posterior fibro-cartilaginous wall of the meatus. A speculum is then introduced into the meatus, and a few drops injected in the region of the junction of its posterior cartilaginous and bony portions.

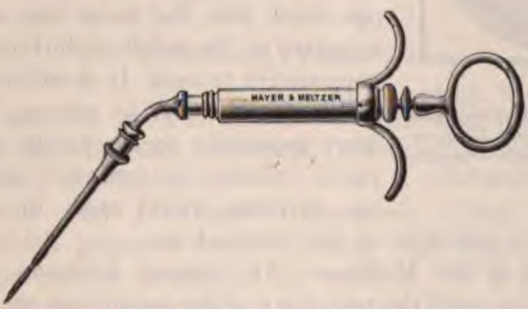

FIG. 9.—Neumann's syringe.

Ossiculectomy.—Removal of the ossicula auditus, the malleus and incus, is indicated in those cases of suppurative middle-ear disease where—(1) they are carious, and where their presence interferes with drainage; (2) where as the result of post-suppurative adhesions their presence interferes with audition; (3) in cases of attic cholesteatomata; and (4) in cases of chronic fœtid suppurative otitis media, where it is possible that their removal may bring about an arrest of the purulent process, and thus save the performance of a Stacke or Küster-Bergmann operation.

Preparation of Field of Operation.—The meatus should be thoroughly syringed with warm 1 in 2,000 perchloride of mercury lotion, followed by the instillation of peroxide of hydrogen

(3 per cent.). The external ear and the skin in its immediate neighbourhood should be washed with ethereal soap, turpentine and spirit, or painted with a 2 per cent. solution of iodine in chloroform. The head should be wrapped up in a sterilised towel with a hole in it, through which the external ear alone protrudes.

In most cases it is advisable to administer a general anæsthetic and to soak the tissues of the middle ear in cocaine-adrenalin solution to obviate so far as is possible hæmorrhage which would otherwise take place and seriously interfere with the performance of the operation. In most cases it is necessary to remove the malleus and incus. It may be found, however, during the performance of the operation that the incus has already disappeared as the result of the long-continued suppurative process. It is seldom necessary, or even advisable, to remove the stapes, more especially so in chronic suppurative cases, where its removal, accidental or on purpose, would open up a path of invasion and infection of the internal ear.

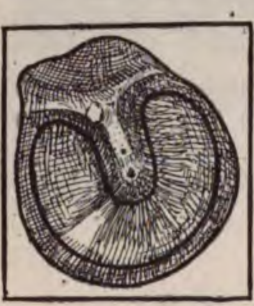

FIG. 10.—Line of incision for removal of membrana tympani. (From Milligan and Wingrave's Diseases of the Ear, Macmillan.)

Removal of the Malleus.—An incision is made under good illumination around the periphery of the membrane, starting at the level of its attachment to the floor of the meatus, and continued as far as the short process of the handle of the malleus, and then parallel to its handle as far as the umbo. Another incision is then made round the anterior periphery of the membrane and along the anterior border of the handle of the malleus until it meets the former incision (Fig. 10). The knife with its cutting edge upwards is inserted just in front of the processus brevis and made to cut upwards so as to divide the anterior fold of the membrane. The posterior fold is then divided in a similar manner. The tendon of the tensor tympani muscle is next cut through with Schwartze's tenotomy knife (Fig. 11). The knife with its cutting edge directed upwards is introduced behind and parallel to the handle of the malleus, and made to cut first upwards and then downwards and forwards until the tendon is divided. The division of the tendon is accompanied by a sharp, crackling noise.

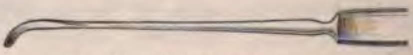

FIG. 11.—Schwartze's tenotome.

The malleus, now freed from all its attachments, may be removed with a pair of crocodile forceps, a wire snare, or Delstanche's *extracteur du marteau*.

(1) *Removal with Forceps.*—The ossicle is grasped as near to its neck as possible, and drawn downwards until its head is below the level of the outer attic wall and then outwards into the meatus.

(2) *Removal with Snare.*—The wire loop of an aural snare is threaded round the malleus as near to its neck as possible. The loop is then tightened and the ossicle drawn gently downwards into the meatus and then outwards.

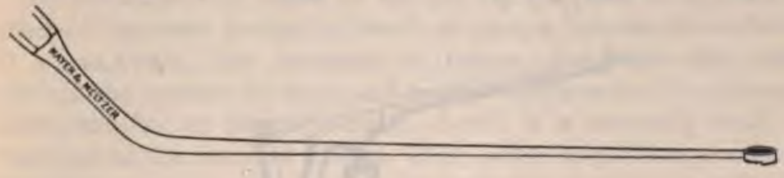

FIG. 12.—Delstanche's Malleus Extractor.

(3) *Removal with Delstanche's Extractor.* — This instrument (Fig. 12), which possesses a sharp cutting edge facing upwards, is made to encircle the handle of the malleus. It is then pushed upwards until its cutting edge is felt to divide the tendon of the tensor tympani muscle. The malleus, held within the ring of the instrument, is then drawn downwards and outwards.

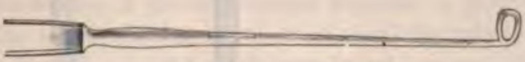

FIG. 13.—Zeroni's hook.

Removal of the Incus.—After having removed the malleus and arrested all hæmorrhage, an examination is made to see if the incudo-stapedial articulation is visible. If possible (in the writer's experience it very rarely is so) a small knife is taken and introduced parallel to the posterior surface of the incus and made to cut downwards and backwards so as to divide the incudo-stapedial ligamentous attachments.

In actual practice the articulation is generally ignored and an incus hook (Ferrer, Ludwig, Zeroni) used to dislocate the ossicle from its attachments and to remove it.

Of the various hooks employed the most serviceable will be found to be Zeroni's. The hook (Fig. 13) is passed into the attic in an upward and backward direction so that its concavity faces backwards and so as to engage the body of the incus within its arms. With a rotatory movement of the handle the incus is tilted from the attic and so into the cavity of the tympanum. It may then be extracted with a crocodile forceps or hook or removed with the syringe.

Removal of the Stapes.—In chronic suppurative disease of the middle ear the stapes is very rarely removed on account of the risk of labyrinthine infection and because, as a rule, its removal is followed by a deterioration of hearing power.

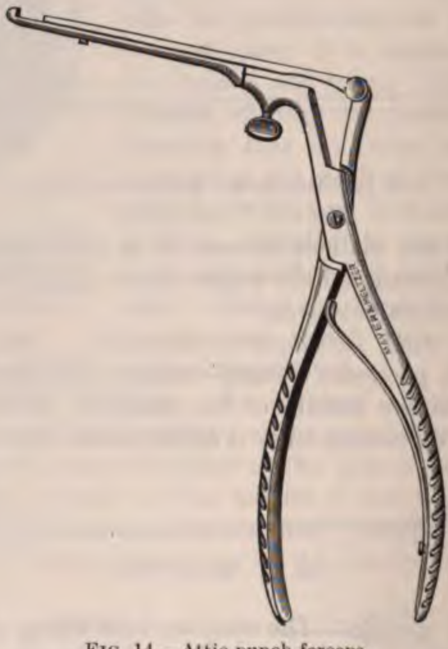

FIG. 14.—Attic punch forceps.

It may be removed through the meatus or by an external operation *à la* Stacke (p. 926).

In suppurative cases, where a portion of the outer attic wall has been destroyed by disease, it is often possible to see the head of the stapes and the stapedio-vestibular articulation. Where it is not visible the posterior portion of the outer attic wall should be removed, when, as a rule, the articulation comes into view. Should the stapedio-incudal articulation be intact it is divided, as also is the tendon of the stapedius muscle.

A fine hook is then introduced between the crura of the stapes and gentle traction made. The ossicle then either comes away entire or minus its foot plate.

Following the removal of the stapes there may be considerable vertigo and at times severe sickness. Rest in bed in the horizontal position for a few days is usually all that is called for. In severe cases it may be necessary to give hypodermic injections of morphia and atropine.

Atticotomy.—In cases of chronic epitympanic suppuration, where it has been deemed advisable to remove the ossicula auditus, it is, as a rule, also necessary to remove the outer attic wall. Should the meatus be large and roomy the operation is comparatively simple; on the other hand, should it be naturally small or stenosed as the result of disease, it is better to perform at once a Stacke's operation. In many cases the outer attic wall is softened by caries and therefore easily cut away; in others it is thick and sclerosed and is only removed with great difficulty. It may be cut away with chisel, gouge or punch forceps (Fig. 14). After having cleansed the meatus and removed any granulation tissue which may be present, the punch forceps is introduced through the speculum under good illumination parallel to the roof of the meatus until its distal blade has passed beyond the outer attic wall and so into the epitympanic recess. The handle of the instrument is then slightly depressed and drawn outwards until the distal blade is felt to impinge against the outer attic wall. By now forcibly pressing the blades of the instrument together a piece of bone is cut away. This manipulation is repeated until the whole wall has been removed and until a bent probe introduced against the roof of the tympanum is capable of being withdrawn without meeting with any obstruction.

Any granulation tissue in the epitympanic recess is then scraped away with curettes (Lake) and the meatus, after thorough cleansing, lightly packed with a strip of double cyanide or iodoform gauze.

In many cases such considerable after-pain is complained of as to necessitate daily dressing and the application of anodyne lotions.

Closure of Perforations.—To obtain cicatrisation of an old and dry perforation, the result of previous suppurative middle ear disease the following methods are in use: (1) The application of caustics or vesicants to the indurated and epithelialised edges of the perforation; (2) radial incisions; (3) circumferential incisions.

(1) As a rule, some caustic application, *e.g.*, trichloracetic acid,

chromic acid or nitrate of silver, is applied to the epithelialised edge of the perforation in order to cause it to slough and separate. The application is made under good illumination, care being taken to localise it to the edges of the perforation. After sloughing has taken place cicatrisation is not only possible but frequently occurs. (2) Several radial incisions may be made with a sharp paracentesis knife across the thickened edge of the perforation in order to produce a reactive inflammation, or (3) the thickened indurated and epithelialised edge may be completely cut away. The process of repair is a concentric one, the perforation becoming gradually smaller and smaller until finally closure takes place.

WILLIAM MILLIGAN.

DISEASES OF THE MASTOID PROCESS.

MASTOID PERIOSTITIS.

Mastoid Periostitis may be primary or secondary. Primary periostitis is rare and is usually of streptococcal origin, being a form of cellulitis or erysipelas involving the periosteum.

Secondary periostitis is, as a rule, the result of extension of disease from the middle ear cleft or of inflammatory affections of the external auditory meatus.

When suppuration has not taken place an effort should be made to promote resolution by the application of leeches, Leiter's hot or cold coil, or dry heat, *e.g.*, salt bags, or bran bags. When, however, the tissues are painful and œdematous it is advisable at once to make an incision down to the bone (Wilde's incision, Fig. 1).

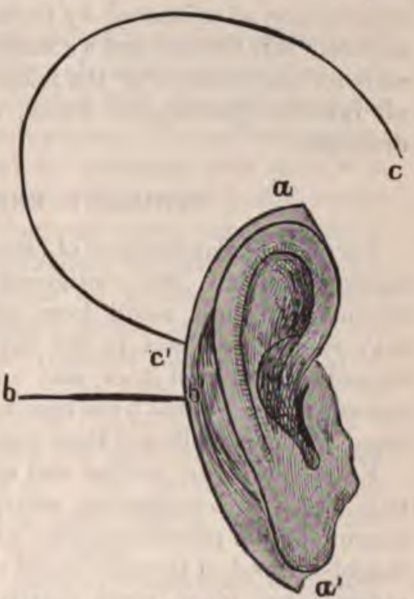

Fig. 1.—Line of incision: a—a', complete post-aural operation; b—b', for exposure of the knee of the sigmoid tissues; c—c', for exposure of temporo-sphenoidal lobe.

In young children this should be done under general anæsthesia; in adults under nitrous oxide, ethyl-chloride, or even local anæsthesia.

The incision should be made parallel to the attachment of the auricle and about ½ inch behind it, and should extend from the base to the apex of the process. It should be left open throughout its entire length until all œdema has subsided, after which the edges may be brought together with sutures or Michel's clips.

After incision the application of hot boracic fomentations tends not only to relieve pain but also to promote resolution.

ACUTE PRIMARY INFLAMMATION OF THE MASTOID CELLS.

Acute primary inflammation of the mastoid cells is rare. It occurs in both the catarrhal and the purulent form, the former being confined, as a rule, to the pneumatic cells, the latter to the diploic tissues. In children the inflammatory process may be so acute as to cause complete destruction of all cellular elements within a few days (acute osteomyelitis).

Should suppuration not have taken place antiphlogistic treatment, *e.g.*, the application of hot spongiopiline, hot bran or salt bags, Leiter's coil, either hot or cold, or from two to four leeches, according to the severity of the inflammatory process, may be tried, or a Wilde's incision made. The presence of suppuration as evidenced by increase of pain, œdema of the superimposed soft tissues, and a considerable elevation of temperature, calls for free removal of the mastoid cortex, evacuation of pus and all infective granulation tissue, and the maintenance of efficient drainage.

PURULENT ENDOMASTOIDITIS.

Purulent inflammation of the mucous membrane lining the mastoid antrum and contiguous mastoid cells may be acute or chronic and may result from acute or chronic otitis media. It may remain localised to the cavity of the antrum and the cells immediately around it, or may spread through the whole cellular spaces of the process from base to apex. Pneumatic processes are more frequently affected than diploetic.

Extension to the antrum and mastoid cells is indicated by severe pain, rise of temperature, œdema of superimposed soft tissues, sagging of the postero-superior wall of the meatus in the immediate neighbourhood of the membrane and profuse discharge. Resolution rarely takes place, more usually the cancellous tissue becomes completely broken down with ultimate erosion of the cortex and formation of a subperiosteal mastoid abscess. In other cases pus tracks backwards towards the sigmoid sinus, upwards into the middle fossa, or into the tissues of the neck through a perforation of the median antral wall (Bezold's mastoiditis).

Rest in bed and in a warm room, a sharp cathartic, and free incision of the membrane should be resorted to at once. The application of leeches over the mastoid process is at times useful. Should the inflammatory symptoms not subside within from three to four days it is advisable to open the antrum and drain the posterior end of the middle ear cleft. Undue delay not only courts disaster but may cause permanent damage to the hearing power.

MASTOID OPERATION.

Preparation of the Patient.—The head should be shaved for a space of from 2 to 3 inches around the ear in the case of male patients. In females it is advisable to preserve the hair in front of the ear in order that during convalescence it may be utilised to cover the bald patch behind the ear, a matter of considerable moment to the patient. It should, however, be thoroughly disinfected by washing with ethereal soap, turpentine and spirit, and kept plastered down by means of a thick layer of collodion or carbolic soap.

The skin within the operation area should be similarly disinfected or painted with a 2 per cent. solution of iodine in chloroform, an efficient method of sterilisation, provided that the epithelium has not been macerated by previous overwashing. The auditory meatus should also be thoroughly cleansed by syringing with warm 1 in 2,000 perchloride or biniodide of mercury lotion and finally packed with a strip of iodoform gauze. A compress wrung out of boracic or 1 in 2,000 biniodide of mercury lotion should be placed over the side of the head and retained in position for at least twelve hours prior to operation. When the patient is under the influence of the anæsthetic the compress should be removed and the operation area once more carefully cleansed. The head should then be enveloped in a towel and a second or "mastoid towel" with a hole in its centre, sufficient to expose the operation area, clipped round the neck with towel forceps. The patient should lie recumbent upon the table with the head resting upon a firm pillow and with the affected ear uppermost.

To secure efficient illumination of the area of operation, especially of its deeper portions, it is advisable to make use of a strong light, *e.g.*, lime or electric light, reflected by means of a forehead mirror or Clar's parabolic electric forehead lamp.

Instruments.—The instruments required for the performance of the mastoid operation are: Knives, artery forceps, periosteal elevators, small and large, self-retaining (Jansen's, Milligan's) rake retractors, various sized gouges and chisels, mallet, probes (sharp and blunt), antrum hook or "seeker" (Schwartze, Grant, Stacke, Fig. 2), bone forceps, Volkmann's spoons, scissors, dressing forceps, angular forceps, sharp hook and needles.

In addition it is advisable to have a hand, foot, or electrically driven bur to smooth down all bony rugosities, or failing this various sized osteotribes (Grant). Prior to operation all instruments should be sterilised and laid out in a flat bottomed dish containing 1 in 40 carbolic lotion.

Indications for Operation in Chronic Suppurative Endomastoiditis.—(1) The presence of an intractable purulent and fœtid discharge from the middle ear tract uninfluenced by local and minor surgical treatment and which upon bacteriological examination is found to contain numbers of streptococci or meningococci and, upon cytological examination, lymphocytes, myelocytes, or acid-fast squames; (2) constantly recurring bone granulations, more especially if of epitympanic origin; (3) the presence of a mastoid cholesteatoma; (4) recurring attacks of acute mastoiditis in cases of chronic suppurative otitis media; (5) the presence of a mastoid fistula leading down to dead or carious bone; (6) tuberculous disease of the petro-mastoid; (7) the occurrence of facial paralysis during the course of chronic purulent otitis media; (8) membranous or bony stenosis of the meatus in cases of chronic purulent otitis media; (9) the presence of a perforation of the posterior superior segment of the membrane combined with caries and an intractable purulent discharge.

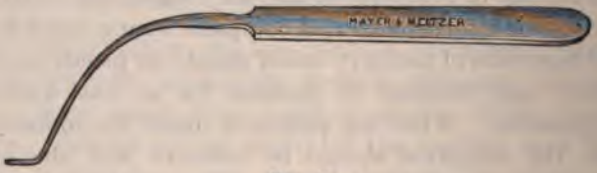

FIG. 2.

Whether a complete post-aural operation (Küster-Bergmann) or a Stacke's operation should be performed depends upon the extent and localisation of the disease and the condition of the middle ear.

The Complete Post-Aural Operation Küster-Bergmann or Schwartze-Stacke).—The exposure of the field of operation is similar to that already described for the performance of the Schwartze operation (p. 898).

After the antrum has been opened the postero-superior walls of the cartilaginous meatus are separated from their osseous attachments and drawn forwards with a rake retractor or strip of bandage passed through the auditory meatus and brought out over the posterior surface of the auricle. The opened-up antrum is then separated from the external auditory meatus by a triangular wedge of bone, "the bridge," whose apex forms the outer wall of the *aditus ad antrum*.

This wedge of bone is then removed by means of a chisel or bone forceps (preferably the former), great care being taken when removing its deeper portions not to injure the facial nerve or external semicircular canal, which lie immediately below it. Such an accident is likely to happen if the chisel is wielded too vigorously or if it should slip suddenly from not being carefully held in the operator's grasp. Many surgeons prefer to have a Stacke's hook held by an assistant in the *aditus ad antrum* to protect the facial nerve, while others pack the *aditus* with a piece of sterilised sponge or lint, upon which they cut down with caution. In removing the bridge the chisel should be made to cut upwards and in a sloping direction, as, if plunged vertically through the bone (the patient lying recumbent), the facial nerve is prone to be injured in its descending portion. The "bridge" having been carefully cut away, sufficient bone is removed to expose freely the facial spur and to convert the antrum, tympanum, and external meatus into one continuous cavity with smooth and sloping walls (Fig. 17). Any remains of the membrane and the malleus and incus are now removed with forceps or curette. Finally the outer attic wall is cut away with a pair of punch forceps or small gouge until the roof of the antrum, aditus and attic form one continuous plane and until a bent probe introduced to the bottom of the cavity meets

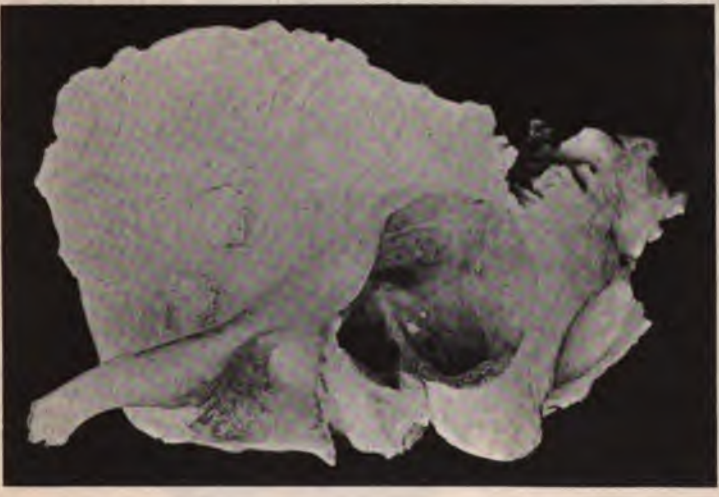

FIG. 3.—The complete post-aural operation (Küster-Bergmann, Schwartze Stacke) showing the extent of the cavity.

with no resistance on being withdrawn. A toilet of the inner tympanic wall should then be performed, care being taken to preserve the mucosa covering it. Exuberant granulation tissue should be removed piecemeal with a Hartmann's forceps or delicate curette. In using the latter instrument care should be exercised not to injure the attachments of the stapes to the margins of the fenestra ovalis. The tympanic orifice of the Eustachian tube should be vigorously curetted or burred with a small conical bur in order to effect its ultimate closure so as to obviate the risk of reinfection of the antro-tympanic cavity from the naso-pharynx.

In exceptional cases, when the hypotympanic recess is unusually deep, it may be necessary to remove a portion of the floor of the external auditory meatus. This is effected by means of a small gouge or chisel.

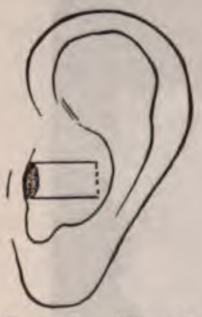

FIG. 4.—Körner's flap. (From Milligan and Wingrave's Diseases of Ear, Macmillan.)

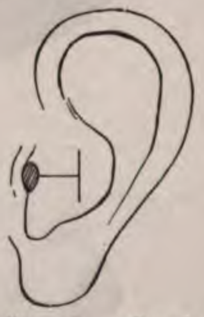

FIG. 5. — Panse's flap. (From Milligan and Wingrave's Diseases of Ear, Macmillan.)

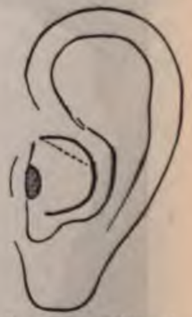

FIG. 6. — Milligan's flap. (From Milligan and Wingrave's Diseases of Ear, Macmillan).

The antro-tympanic cavity having been thoroughly cleansed and disinfected, flaps are now cut from the posterior wall of the cartilaginous meatus in order to cover as much of the exposed bony walls of the cavity as possible and so to promote their epidermisation and also to obviate stenosis of the meatus.

Various methods of cutting flaps are in use, the following being the most useful:

(1) **Körner's Flap.**—Incisions are made along the junction of the postero-superior and postero-inferior walls of the cartilaginous meatus vertically outwards into the concha. A quadrilateral flap (Fig. 4) is in this way formed which, when the auricle is replaced, covers a considerable area of the posterior wound surface. It is kept in position by means of packing introduced through the now enlarged opening of the external auditory meatus.

(2) **Panse's Flap.**—A vertical incision is made along the centre of the posterior cartilaginous wall of the meatus as far outwards as its junction with the concha. At this point an incision is made at right angles to the former, so that two flaps, an upper and a lower (Fig. 5), are fashioned. These flaps are turned, the one upwards and the other downwards, against the bone wound and are kept in position by means of stitches passed through the soft tissues at their upper and lower angles.

(3) **Milligan's Flap.**—A long and thin-bladed knife is inserted into the cartilaginous meatus at the junction of its upper and posterior walls and an incision made vertically outwards into the concha. With a sweeping motion an incision is made through the concha parallel to the curve of the antihelix down to the floor of the auditory meatus (Fig. 6). The flap thus formed is turned downwards on to the floor of the bone wound and is kept in position by means of a couple of sutures passed through it and the adjacent skin and tied over a piece of rubber tubing.

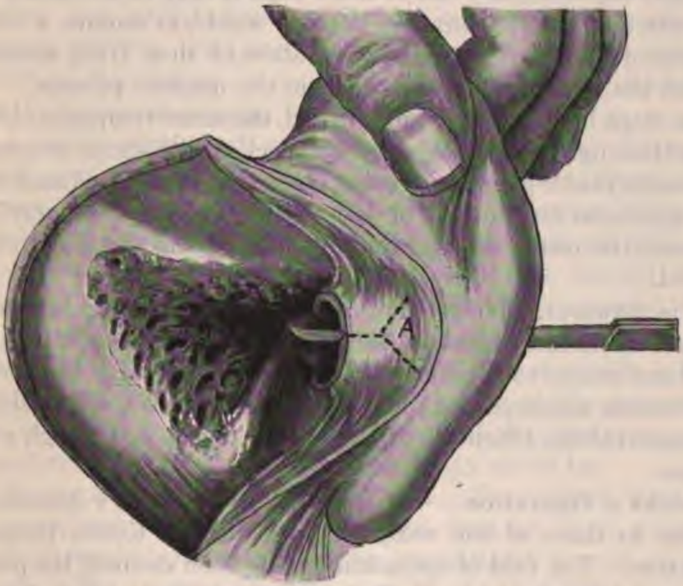

FIG. 7.—Hunter Tod's flap. (From Burghard's Surgery, Hodder and Stoughton).

(4) **Hunter Tod's Flap.**—The auricle is drawn forwards and a long and slender knife introduced into the meatus with its cutting edge directed backwards. An incision is then made outwards in the

middle line of the posterior wall of the meatus for about half its length. The cutting edge of the knife is then turned upwards and made to cut obliquely upwards and outwards as far as but not into the concha. The knife is then withdrawn and reinserted at the end of the horizontal incision and made to cut downwards and outwards as far as the concha (Fig. 7). The tongue-shaped flap thus formed is folded backwards and stitched to the skin behind the auricle while the upper and lower flaps are pushed upwards and downwards respectively and kept in position by sutures or packing introduced through the meatus.

Before adjusting any one of these flaps it may be necessary to do a certain amount of trimming, in other words, to remove a certain amount of redundant tissue so as to allow of their lying accurately against the bony walls of the cavity in the mastoid process.

The flaps having now been adjusted, the antro-tympanic cavity is again thoroughly cleansed, dried and packed with strips of iodoform or double cyanide gauze, care being taken that it is introduced evenly and lightly to the bottom of the cavity. Finally the auricle is replaced, the retro-auricular incision sutured and suitable dressings applied.

It is, however, advisable not to close the retro-auricular incision in cases where there has been a subperiosteal abscess and where there has been extensive exposure of the dura mater and walls of the lateral sinus accompanied by extensive bone disease, and in children on account of the difficulties of successfully repacking through a small meatus.

Stacke's Operation.—The initial steps of Stacke's operation are similar to those of the complete post-aural or Küster-Bergmann operation. The field of operation having been defined, the postero-superior wall of the cartilaginous meatus is separated from its osseous attachments by means of a small raspatory and along with the auricle is drawn forwards with a rake retractor or strip of bandage. Any granulation tissue which may be present along with the remains of the membrane, malleus and incus is now removed. The outer attic wall is then cut away with a punch forceps or small gouge so as to bring the epitympanic recess into view. A Stacke's protector or Grant's hook is then introduced in a direction upwards and backwards along the *aditus ad antrum*. The superimposed bone, *i.e.*, the bone forming the upper and posterior wall of the auditory meatus, is now carefully removed with a small gouge until the anterior wall of the antrum is exposed. During this manipulation the bent probe is pushed gradually backwards, partly as a guide and partly in order to protect the external semicircular canal and the

Fallopian aqueduct, which lie immediately beneath it. The anterior wall of the antrum is now removed and its cavity exposed. All overhanging bone is then cut away until the antrum, attic, tympanum and auditory meatus form one cavity with smooth and sloping walls.

Stacke's operation is indicated in those cases where there is reason to believe that the disease is limited to the middle ear, attic and antrum, and that the contiguous mastoid cells are not involved; (2) in those cases where the mastoid process is composed of dense sclerotic bone, and where the antrum has not been found by removal of bone, as in the Küster-Bergmann operation; and (3) in those cases where during the performance of the Küster-Bergmann operation the lateral sinus is found situated far forwards and associated with a low-lying middle fossa. In such cases the exposure of the antrum is much facilitated by working backwards along the *aditus ad antrum*.

In a small number of cases of extensive disease of the mastoid antrum and contiguous mastoid cells, but where there is no apparent infection of the outer attic wall or ossicula auditus, it is justifiable to leave the contents of the middle ear untouched, in other words, the post-aural operation should be limited to an exposure of the antrum and adjacent cells and to removal of the posterior bony meatal wall. In chronic cases it is, however, very rare to have the antrum and the mastoid cells extensively infected without simultaneous infection of the contents of the tympanum, hence in actual practice this *modus operandi*, originally suggested and performed by Jansen, of Berlin, is rarely called for.

After-treatment of Operation Cases.—The patient should be kept quiet and in bed for at least ten days, as by so doing the process of repair is hastened and the granulations formed are more vigorous. The external dressing may be changed every second or third day, but the deep dressing or packing should be left for five or six days, provided that the general condition is good and pulse and temperature about normal. The removal of the gauze packing (always a painful process) is facilitated by soaking it with peroxide of hydrogen (3 per cent.). After its removal the cavity should be syringed with warm sterile salt solution or some weak antiseptic lotion, and its walls carefully inspected. Any tendency to exuberance of granulation tissue should be checked by the application of chromic acid, nitrate of silver or trichloracetic acid. Subsequent treatment may be carried out by packing or by the instillation of alcohol drops or antiseptic lotions. The main objection to packing is that it is painful and that the walls of the cavity are kept in a sodden condition.

The method adopted by the writer is to pack the cavity at the time of operation and to leave the packing *in situ* for five or six days, then to remove it and to carry on further treatment by the instillation of a saturated alcoholic solution of boracic acid or drops of rectified spirit.

The idea is to encourage the "papering" of the walls of the cavity with epithelium derived from the edges of the flaps cut from the fibro-cartilaginous meatus for the purpose of covering a portion at least of the bone wound. Under favourable circumstances this epithelialising of the walls of the cavity takes from six to eight weeks, and at times longer, the main practical difficulties being to keep the cavity aseptic and to overcome the tendency to the formation of exuberant granulations. As a rule, it is customary to close the external wound except where there has been a superficial abscess, œdema of the soft tissues, or a foul bone lesion. At times a tendency to stenosis of the meatus is noted, especially where the flaps have not been properly adjusted and fixed. Efficient packing or the insertion of a rubber tube in the meatus is sufficient to overcome this difficulty. Should, however, treatment by "packing" be decided upon, the gauze tampons should be removed every

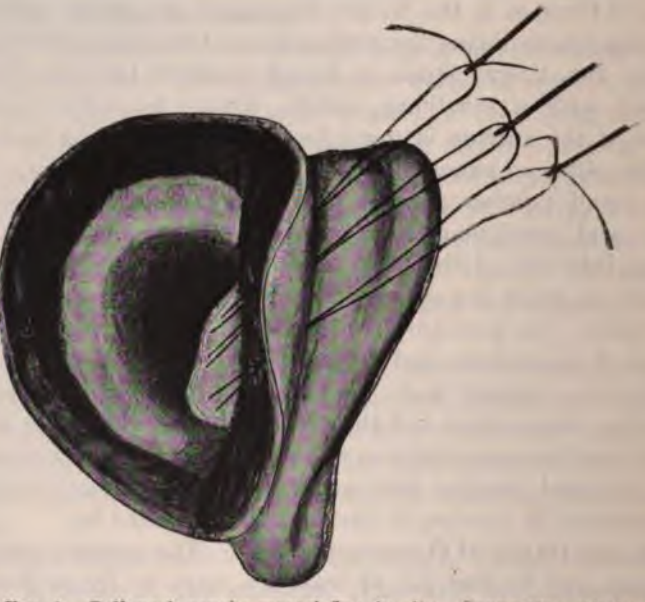

FIG. 8.—Ballance's concho-meatal flap *in situ*. Supporting stitches pulled tight so that the raw surface of the concho-meatal flap is fitted against the raw surface of the mastoid flap.

second or third day, the cavity syringed and then repacked. Once the flaps have become firmly adherent to the underlying bone less and less packing is required, provided that there is no tendency to the formation of exuberant granulation tissue.

Ballance's Operation.—To facilitate the epithelialising of the antro-tympanic cavity, C. A. Ballance has suggested the employment of large skin grafts applied to its walls. A complete post-aural operation is first performed, particular attention being devoted to making the bony surfaces as smooth as possible. A large flap is cut from the posterior cartilaginous wall of the meatus in the following manner: With a long and narrow knife the inferior wall of the meatus is cut through vertically, the incision being carried outwards and into the concha, and then with a curve upwards and backwards until it reaches the anterior commencement of the helix. The flap thus formed is folded upwards and backwards, and is attached by silkworm-gut threads to the original mastoid flap (Fig. 7) raw surface to raw surface.

The accurate apposition of the flap is facilitated by the removal of all redundant tissue, including cartilage if necessary.

The bone cavity is now thoroughly cleansed, disinfected with strong antiseptic solution, and packed with gauze. The post-auricular incision is completely sutured and a dressing applied. The external dressings are changed every second or third day, but the gauze dressing in the antro-tympanic cavity is left alone for at least five or six days, except in those cases in which there has been extensive and foul bone disease. In children "grafting" may, as a rule, be performed at the end of a week; in adults in from ten to fourteen days after the primary operation. The day previous to the grafting operation all packing is removed and the cavity thoroughly cleansed. The area from which the graft is to be cut, preferably the anterior surface of the left thigh, is washed with soft soap and water, shaved if necessary, and covered with an antiseptic gauze dressing which is left on until the grafting operation takes place. On the morning of the operation the antro-tympanic cavity is thoroughly irrigated with warm sterilised salt solution. The post-auricular incision is re-opened, and all oozing of blood carefully arrested by syringing with hot sterile water or by the application of sterilised 1 in 1,000 adrenalin solution. A large graft is now cut from the thigh and from an area of skin where there are few hair follicles. To secure a good graft the skin should be tightly stretched. This is most readily accomplished by an assistant pressing a wooden roller against the upper part of the thigh, and by the operator placing his left hand across the thigh a little above the knee joint and making forcible downward traction. The skin from which the graft is to be cut should be moistened with a glycerine-alcoholic solution of salt (normal saline solution ℥vij, glycerine ʒij, and alcohol ʒj), and the razor dipped in the same solution. A large and thin graft is then cut and floated off the razor into a flat dish containing normal salt solution and on to a suitable sized lifter (Fig. 9). The lifter is then taken and placed against the edge of the anterior wall of the cavity, and the graft gently coaxed with a needle on to the edge of its roof just below the linea temporalis and held there. The lifter is now carefully withdrawn, leaving the graft over-hanging the wound in the bone. With care the graft is partly pushed and partly sucked into the cavity with a pipette so as ultimately to lie flat against the following parts: (1) The anterior wall of the cavity; (2) the roof of the cavity formed by the tegmen tympani and superior wall of the enlarged osseous meatus; (3) the inner walls of the attic and tympanum; (4) the tegmen antri; (5) the ridge formed by the Fallopian aqueduct; (6) the inner antral wall.

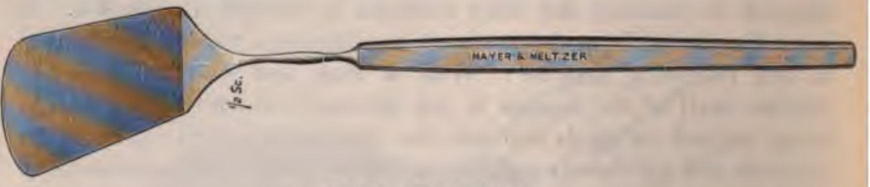

FIG. 9.—Graft lifter.

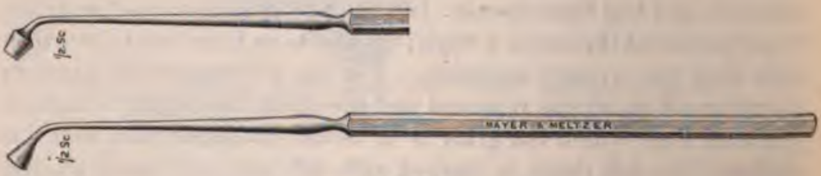

FIG. 10.

Great care should be taken to press the "graft" home with stoppers (Fig. 10), while all air and blood should be sucked out from underneath it with a pipette.

Where one graft is not sufficient to cover the denuded bone, several may be required, care being taken to avoid overlapping of grafts or intervals between them.

A sheet of gold-leaf, $\frac{1}{16000}$ to $\frac{1}{20000}$ inch in thickness, is taken and stoppered down upon the surface of the graft until the various eminences and depressions are accurately and evenly covered (Fig. 11). A strip of dry gauze is then packed into the cavity, or the cavity is filled with small pellets of sterile wool wrapped in sterile gauze. The retro-auricular incision is now sewn up and ordinary dressings applied.

Instead of stoppering the graft into the cavity the cavity may be filled with warm sterile salt solution, the graft floated upon the fluid, and the fluid then sucked out from the cavity (Milligan).

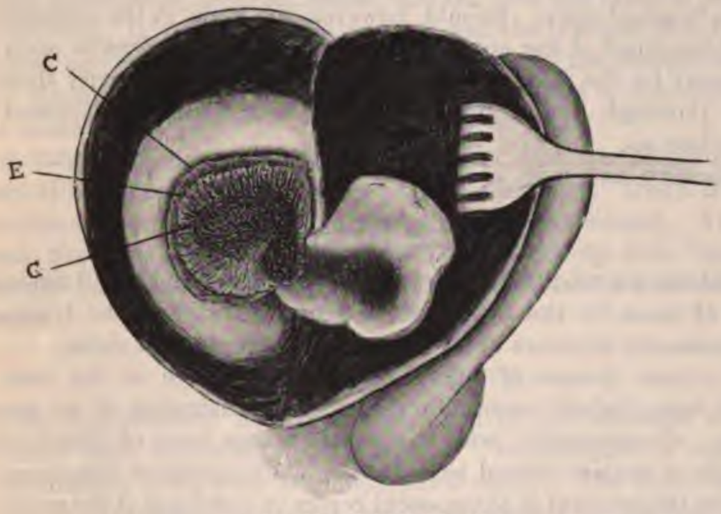

FIG. 11.—Gold leaf *in situ*.
C, superficial edge of operation cavity; E, epithelial graft; G, gold leaf.

As the fluid is gradually sucked out the graft sinks down into position.

In from three to four days the gauze or the pellets should be removed and the gold-leaf picked out with a pair of forceps or removed by syringing. Should the graft have united the antro-tympanic cavity will be seen to be mapped out with a cutaneous lining, the superficial cells of which may have decomposed and desquamated, while the deeper cells are active and have become firmly adherent to the delicate layer of granulation tissue covering the bony walls of the antro-tympanic cavity.

The main advantages of the grafting operation are that, should the graft adhere, healing is much more quickly accomplished, while frequent and often painful dressings are avoided; the main disadvantage is that a second anæsthetic has to be administered.

INFLUENZAL MASTOIDITIS.

One of the peculiarities of post-influenzal suppurative otitis media is its tendency to invade the subcortical mastoid cells, especially those situated towards its apex.

Rapid disintegration of the cellular spaces takes place with resulting abscess formation.

In the treatment of such cases free removal of the cortex is called for with ablation of all infective granulation tissue and softened bone. As a rule, it is unnecessary to open the mastoid antrum, the abscess being usually localised to the neighbourhood of the mastoid apex. Should, however, the cells in the immediate neighbourhood of the antrum be involved, it is prudent to open it, if merely for the purpose of inspection. The exposed cavity should, after thorough disinfection, be packed with gauze and allowed to granulate up.

Recovery, as a rule, is rapid.

DIABETIC MASTOIDITIS.

Diabetic mastoiditis is characterised by great and rapid destruction of bone, by the formation of sequestra, and by the frequent and extensive exposure of the dura mater and sigmoid sinus.

The main danger of any operative interference is the risk of death from diabetic coma following the administration of an anæsthetic. Consequently, prior to operation large doses of bicarbonate of soda or codeine should be ordered. Any operative interference, such as the removal of the mastoid cortex or curettage of the mastoid cells, should be performed as quickly as possible, the idea being to keep the patient as short a time as possible under the influence of the anæsthetic.

The ordinary post-aural incision (Wilde's incision) is first made and the mastoid cortex exposed. Sufficient bone is then removed with a gouge or Volkmann's spoon to afford free exit to the pent-up products of suppuration. The cavity in the mastoid process should then be lightly packed with iodoform gauze and the retro-auricular incision kept open so as to afford every facility for successful drainage.

BEZOLD'S MASTOID ABSCESS.

In this particular form of suppuration perforation of the inner mastoid table takes place with formation of an abscess in the region of the digastric fossa and under cover of the deep cervical fascia.

Circumstances which favour its development are the existence of pneumatic mastoid process with large apical cells and a cortex of fficient thickness to resist the passage of pus outwardly.

The collection of pus pent up under the deep cervical fascia is one to spread downwards amongst the tissues of the neck, en as far as the mediastinum or backwards under the base of e skull.

The cortex is first freely removed, the antrum opened and com- ete ablation of all infected cells effected, the apex of the process ing removed if necessary. The fistulous tract upon the inner ical wall should be looked for and enlarged if necessary. A stout obe should then be taken, passed into the neck and made to project ternally. It is then cut down upon and the infected area freely ened up; or the finger may be introduced into the abscess cavity d its limits defined, any septa which exist being broken down at e same time.

A large drainage tube should be drawn downwards along the ct of the abscess and made to project externally. Daily irriga- on should be practised until all suppuration has ceased. At the me time the cavity should be allowed to fill up with healthy anulation tissue, the ultimate idea being to obtain a firm fibrous atrix.

LATENT MASTOIDITIS.

The characteristic feature of this form of inflammation of the astoid cells, according to Politzer, is "an absence of reactive flammatory symptoms in the tympanic cavity. The intact mem- ane is cloudy and lustreless, the blood-vessels of the handle of e malleus are injected and the osseous canal is slightly reddened. e hearing power is just as in middle ear catarrh, slightly paired."

In such cases, undoubtedly somewhat rare, it is advisable to rform an exploratory operation, viz., to remove the mastoid tex, and, if necessary, to explore the antrum.

Should infection of the cellular elements of the process be esent, removal of all bony septa should be effected and the cavity s formed packed with gauze and allowed slowly to granulate up m the bottom.

WILLIAM MILLIGAN.

CHOLESTEATOMA.

Cholesteatomata are now generally looked upon as the result of the ingrowth into the middle ear of the epithelial lining of the auditory meatus through a perforated membrana tympani combined with a desquamative inflammation of the tympanic mucosa.

They are much more frequently met with in cases of marginal perforations (postero-superior segment of membrane, attic perforations), and where some obstructive lesion exists within the middle or external ear. Obstruction of the Eustachian tube also favours their formation. Occasionally they are due to the ingrowth of epithelium through a fistula in the mastoid cortex or posterior wall of the bony meatus (secondary cholesteatoma). They also occur in the form of fœtal inclusions.

They vary in size, being at times very small, at other times as large as a walnut. As the result of gradual increase in size and pressure upon surrounding bone they are prone to open up the labyrinthine cavity, the middle or posterior fossæ or to penetrate the mastoid cortex and present under cover of a subperiosteal mastoid abscess.

Treatment.—When the perforation of the membrane is small it should be freely enlarged. Forcible syringing with an intratympanic syringe serves in certain cases to cause extrusion of the mass. Its contraction may be assisted by the instillation of rectified spirits or salicylic acid in aniline oil. The gentle use of a curette or small spoon serves at times to detach or to break up the mass, after which it may be more easily washed out. Intratympanic treatment is usually, however, useless except when the cholesteatoma is very small and of recent formation. As a rule, some form of post-aural operation has to be resorted to, the extent of operation depending upon the size, situation and extent of the mass, the idea being to secure a cavity with healthy walls which may subsequently be grafted or allowed to fill up with granulation tissue.

Unless thoroughly removed there is a great tendency to recurrence.

The suggestion recently made to leave the matrix of the cholesteatoma behind to serve as the lining membrane of the cavity exposed by operation (Dundas Grant, A. Hartmann) has not received much support, the matrix being regarded by most otologists as the product of a morbid process.

WILLIAM MILLIGAN.

TUBERCULOUS DISEASE OF THE MIDDLE EAR AND ITS ACCESSORY CAVITIES.

Tuberculous disease of the mucous membrane lining the middle ear tract may be primary or secondary. The former is more common in infants and young children; the latter in adults, especially amongst those suffering from pulmonary tuberculosis. The various channels of infection are: (1) Aërial; (2) lymphatic; (3) vascular; and (4) along sub-epithelial collections of lymphoid tissue.

The characteristic features of the disease are the painless advent of suppuration, the presence of one or more perforations of the membrana tympani, the early appearance of facial paralysis and enlarged peri-auricular glands, and the tendency to the formation of sequestra.

The age of the patient, the duration of the disease, the general condition, and whether the disease is primary or secondary, should be carefully considered, as certain cases are operable and curable, others inoperable and incurable.

Cases suitable for operation are those where the general condition is satisfactory, the disease primary, and where there is not any marked glandular enlargement; also cases of secondary origin, where there is reason to believe that the removal of the temporal bone lesion would in all probability relieve the existing disease in the lungs, bones or joints, are as a rule adjudicated as suitable.

Inoperable cases are those occurring in weakly infants where there exists facial paralysis, marked glandular enlargement, and evidence of extensive temporal bone caries; also cases of secondary origin, where tuberculosis in other organs is advanced and when the patient is emaciating rapidly.

The indication is to remove, if possible, all tuberculous and infected bone, and to provide efficient drainage. In infants and young children it is advisable to operate by "stages," *e.g.*, at one time opening up an abscess and at another removing diseased bone, enlarged glands, etc.

As a rule, no typical operation is possible, the surgeon's main idea being to remove all diseased bone, exposing if necessary the dura mater of the middle and posterior fossæ and the interior of the pars petrosa. As the facial nerve is already frequently paralysed prior to operation and the function of the internal ear destroyed, extensive removal of bone is rendered comparatively easy.

In such cases an attempt should be made to cause obliteration of the cavity with granulation tissue, the anterior (cutaneous) wall of the meatus being removed to facilitate the process.

WILLIAM MILLIGAN.

INTRA-CRANIAL AND INTRA-VENOUS COMPLICATIONS OF EAR DISEASE.

The intra-cranial and intra-venous complications of ear disease are meningitis; brain abscess, and encephalitis; and thrombosis of the sigmoid sinus, of the superior and inferior petrosal sinuses, of the cavernous sinus, and of the jugular bulb and vein.

MENINGITIS.

Meningitis may take the form of a pachymeningitis externa or interna, of a leptomeningitis, or of a meningitis serosa. When the dura mater has been exposed by the destruction of the bone with which it is in immediate contact a localised pachymeningitis follows. The dura mater becomes thickened, granulation tissue is produced, and adhesions are formed externally to the edges of the fistulous opening in the bone and internally to the arachnoid. Pus may collect between the dura mater and the bone, forming an extra-dural abscess.

Such a state of affairs might give rise to the characteristic symptoms of an extra-dural abscess, but in many cases no symptoms at all may be present. In these the condition is only discovered at the time of operation, and the necessity for a most careful and complete operation in all cases of chronic otorrhœa is clearly indicated. When such a condition of the dura mater as is above described is found to exist, the main indication in operative treatment is a free and complete exposure of the whole of the affected surface.

Sufficient bone must be removed to secure a ring of absolutely healthy dura round the entire diseased area. It is not desirable to curette or otherwise interfere with the granulations on the dura mater, although they may be swabbed over with hydrogen peroxide (10 vols. strength). After complete exposure and adequate drainage a speedy cure results.

If the affected area of dura is large, and especially if it is situated in the posterior fossa, it will be advisable to leave the posterior incision partially open. Three or four of the middle stitches may be left untied, being merely knotted at their extremities, and tightened on the second or third day if the wound is found to be perfectly clean and healthy. A gauze drain should be kept between the edges of the wound in the meantime. It is often of advantage not to form a meatal flap, but to cut away entirely the soft tissues forming the posterior meatal wall.

When a meningitis has once spread beyond the inner surface of the dura, a much more serious condition exists. In the meningitis of the plastic or toxic varieties operative interference is rarely of use; in the type described as meningitis serosa efficient drainage affords a distinct chance of a successful issue.

It is necessary to secure both spinal and cerebral drainage. The former is best accomplished by repeated lumbar puncture or by lumbar drainage; the latter by opening the dura mater in the cerebral or cerebellar regions of the mastoid, or by opening through the labyrinth and internal auditory meatus. Lumbar puncture is effected through the space immediately below the fourth lumbar spine, lying on a level with the highest point of the iliac crest; the needle and trocar are inserted a little to the left of the middle line, the point being directed slightly upwards and inwards, the body being in the semi-prone position, turned to the left. Very careful preliminary disinfection of the skin should be carried out to prevent the risk of infection. The fluid should be allowed to escape until the flow is merely by drops, when an aseptic pad must be applied. If drainage is thought advisable, the cannula must be left *in situ*, and the discharge collected by sterilised wool enclosed in a thin sheet of rubber.

The first step to secure adequate cerebral drainage must be the performance of a complete radical mastoid operation, after which the bone must be extensively removed so as to expose freely the dura in the immediate vicinity, the skin incision being prolonged in whatever direction may be necessary. A flap is then cut in the dura, and a gauze drain laid on the surface of the brain and brought out through the post-aural incision, the upper part only of which is closed by two or three silkworm-gut sutures.

The outer dressing will probably require to be changed frequently, but the gauze drain may be left undisturbed for thirty-six to forty-eight hours. When infection has taken place through the internal auditory meatus, drainage through the labyrinth and internal meatus may afford the best chance of success.

When drainage through the labyrinth is decided upon, the radical mastoid operation is an essential preliminary step; the vestibule is then opened by cutting away the margin of the fenestra rotunda and removing the bridge of bone between the fenestra ovalis and the fenestra rotunda. By suitable curettes the vestibule is freely opened up and curetted, and then the inner wall separating it from the internal auditory meatus is broken through. A bent wire is then passed through the internal meatus to serve as a drain. Subsequent dressings must be carried out under the most rigid aseptic conditions.

BRAIN ABSCESS.

Although in some cases of brain abscess localising signs are present, indicating in which direction exploration should be made, it unfortunately happens that in many the diagnostic signs are absent, although the general symptoms of intra-cranial pressure are so definite as to necessitate exploration. In these cases great assistance is often afforded by a careful inspection of the walls of the cavity in the temporal bone, after the performance of the preliminary mastoid operation, which is the first essential step in the operation for brain abscess of otitic origin.

The only condition under which the preliminary mastoid operation may be omitted would be the sudden onset of urgent symptoms of intra-cranial pressure, such as unconsciousness with cessation of respiration, in a case where the previous symptoms enabled the position of the abscess to be located. In such a case trephining may be performed over the temporo-sphenoidal or cerebellar area while artificial respiration is being carried on, the temporal bone disease being removed on a subsequent occasion.

If there is reason to suspect the presence of a **temporo-sphenoidal abscess**, the roof of the antrum and of the middle ear must be freely removed, and it is advantageous to remove a small amount of the bone forming the lower portion of the temporal fossa. The dura mater over the lower portion of the temporo-sphenoidal lobe having been in this way freely exposed, it may be found in some cases that a fistulous opening into the cranial cavity exists, or a patch of localised pachymeningitis may indicate the path of extension. In such cases the incision through the dura mater would obviously be made through the affected part. In most instances the outer surface of the dura appears perfectly healthy. The presence or absence of brain pulsation is of no significance. An incision dividing the dura mater through the whole of the exposed area from within outwards appears to expose the cerebrum most satisfactorily with the least hæmorrhage.

The subsequent exploration of the brain tissue proper may be made with one or other of the various "searchers" which have been designed, or a narrow, probe-ended knife may be used. The writer has been in the habit for some time past of using a glass tube about 7 millimètres in diameter and 15 centimètres long, bent at a right angle in the middle. The exploration must be directed forwards and backwards as well as upwards, the tube being withdrawn between each puncture. With a tube of the nature described very little injury is inflicted upon the brain tissue. When the abscess has been reached, the tube should be held in position and a pair of dressing forceps passed alongside into the cavity; the forceps are then expanded so as to dilate up the opening into the abscess, and with another pair of forceps a large rubber drainage tube is passed along the side of the first pair. The larger the tube the more satisfactory is the subsequent drainage and the more rapid the process of healing.

If the cavity is very large and much necrosed brain tissue is present, two tubes may be inserted side by side. The extreme upper portions of the post-aural incision may be closed with two or three sutures to prevent a subsequent unsightly dropping of the ear, the tube being brought out below; but it is most undesirable to hinder free access to the cavity of the brain abscess by closing the wound too completely. It is generally advantageous not to form the usual meatal flap, but to cut away the posterior meatal wall to prevent subsequent contraction of the meatus. In most cases of chronic brain abscess daily irrigation gives the best results, and the presence of a second tube when the cavity is large ensures a complete egress for the irrigating fluid. A solution of hydrogen peroxide (1 in 10 of the 10 vols. strength preparation) is very effective. If the irrigation is carried out carefully, avoiding the use of force, there appears to be no risk, and the removal of pus and necrosed brain tissue is much facilitated.

The period during which the tube should be retained must depend upon the size of the cavity and the nature of its walls. When a thin defined capsule is present the walls of the abscess fall quickly together, and early obliteration results; but in some cases it will be necessary to retain the tube even for several weeks. It may be shortened from time to time, but it is of great advantage to keep in a wide tube for as long as possible.

When the diagnostic signs indicate the presence of a **cerebellar abscess**, or when exploration has failed to discover an abscess in the temporo-sphenoidal lobe, the cerebellum must be explored. Infection spreads to the cerebellum either through the labyrinth, or through the inner wall of the lateral sinus, or through the area of bone bounded above by the superior petrosal sinus, internally by the posterior semi-circular canal, and externally by the lateral sinus. In all cases the cerebellum will be most satisfactorily explored through this area, the abscess being almost invariably situated near the posterior surface of the petrous bone. This method of exploration, anterior to the sigmoid sinus, advocated for several years by the writer, is now almost generally adopted.

Exploration through a separate trephine opening posterior to the sinus is never satisfactory; the abscess itself may even be missed, especially if lying in close contact with the posterior surface of the petrous bone, as is frequently the case. Even if the abscess is discovered, it is only reached through a considerable area of healthy brain tissue, through which drainage must subsequently be carried out. In such a case there is grave risk of setting up a spreading œdema of the brain from infection of the track through which the abscess is drained.

The removal of bone over the dura in the area indicated is at times somewhat difficult, but a sufficient amount of dura can always be exposed to permit of a free opening, adequate exploration and subsequent satisfactory drainage. The essential preliminary is to expose the sigmoid sinus by chipping away the bone forming the external part of the posterior wall of the mastoid; when the sinus is once clearly defined and identified the exposure of the dura in the area desired is much simplified.

The incision in the dura may be made parallel with the course of the sinus, to avoid any possible risk of accidental injury to it, the subsequent exploration of the brain substance being made as in cases of temporo-sphenoidal abscess, the trocar in this instance being directed backwards and inwards and slightly upwards. The tube is brought out through the posterior incision, which is left open, with the exception of two or three stitches above. Irrigation does not seem so necessary in cerebellar as in temporo-sphenoidal abscess, but as large a tube as possible should be used.

THROMBOSIS OF THE SIGMOID SINUS.

This condition may be present without any diagnostic signs, or, in fact, without any symptoms pointing to an extension of disease beyond the limits of the temporal bone. In children, especially where long-standing disease of the mastoid is present, a localised pachymeningitis externa may spread to the sinus, which may then be gradually obliterated and ultimately entirely destroyed, so that at the time when the mastoid operation is performed the posterior bony wall may be found to have been entirely destroyed and replaced by granulation tissue, and no definite structure which can be recognised as the wall of the sinus remains. In these cases the careful removal of the granulation tissue will suffice to eradicate the disease, the upper portions of the sinus being blocked by a firm aseptic clot, which need not be removed, the lower end of the jugular bulb being similarly closed.

Where there is a phlebitis alone, or a partial or annular thrombus, the diagnosis must be made from clinical evidence, the sinus when exposed by operation appearing healthy, the walls normal, and the lumen apparently containing fluid blood. In other cases, where a limited extent is thrombosed, the affected area will often be indicated by the altered appearance of the affected part and by its firmness on palpation.

The first essential step is the performance of the radical mastoid operation, or in cases of sinus complication with acute otitis media, a complete Schwartze's operation. The descending portion of the sinus is then exposed by cutting away the posterior bony wall of the mastoid. At least 1 inch of the sinus should be exposed, to allow a complete examination to be made. In all cases where it is decided to open the sinus, sufficient bone must be removed to expose the sinus backwards until a healthy area is reached; a linear incision may then be made with a sharp-pointed tenotome, and the hæmorrhage checked by a gauze plug inserted within the sinus, or between the sinus and the overlying bone. The bleeding having been entirely arrested, the outer wall may be slit up deliberately and the lumen carefully inspected, all unhealthy clot being removed. This procedure is clearly much safer than opening up the sinus directly in the thrombosed area and prolonging the incision backwards, removing clot until hæmorrhage is established, and plugging the lumen with gauze. There is a serious danger in this method of pushing backwards, with the gauze packing, a portion of the septic clot, which would re-infect a further portion of the sinus, and might give rise to a general pyæmia.

It is most essential that the whole of the thrombosed portion of the sinus should be exposed, and the overlying bone must be removed and the sinus laid open until the end of the thrombus is reached. All clot must also be completely removed from the descending portion of the sinus, and the upper portion of the jugular bulb carefully curetted.

The advisability of tying the internal jugular vein before or after the operation on the upper part of the sinus is still under consideration. If the walls of the jugular are healthy, but the blood stream contaminated by septic material from the thrombosed area above, ligature of the jugular prior to the operation on the sinus would be followed by the formation of a septic thrombus above the point ligatured, from which extension into the higher tributary veins might take place. If the whole of the thrombosed portion of the sinus can be completely exposed and the septic clot removed, ligature of the jugular would seem to be unnecessary, and this view is completely supported by the experience of the writer. If, however, the clot extends below the jugular bulb, a simple ligature of the vein is not sufficient. The vein must be thoroughly exposed upwards to the bulb and downwards so far as the clot extends, and then excised, together with a short length of each tributary vein. A small curette may then be passed upwards into the lower portion of the bulb, and the bulb subsequently syringed out through the open end of the vein.

The incision in the neck must not be entirely closed, a long rubber tube with lateral openings being laid along the whole length, extending upwards to the bulb, and brought out at the lower end of the wound. The post-aural incision is left entirely open, with the exception of two or three stitches above, the cavity being packed with gauze. The tube in the neck may be removed in a few days, the mastoid and sinus must be dressed each day, the gauze plugs being gradually removed from the sinus (the more superfluous ones first, the deeper ones being gradually loosened and replaced on any sign of hæmorrhage). Healing will take place entirely by granulations.

Adequate exposure of the superior and inferior petrosal sinuses by the removal of the covering portions of the temporal bone is impracticable, and a partial exposure is not sufficient to arrest the spread of infection in cases of thrombosis extending into these sinuses. Thrombosis spreading to the cavernous sinus, indicated by proptosis of the eye and chemosis of the conjunctiva, is not amenable to surgical interference. In all cases of intra-venous infection, as the organism is usually the streptococcus pyogenes, a full dose of anti-streptococcus serum, 20 cubic centimètres, may be given as soon as the diagnosis is made, and repeated if necessary.

A. L. WHITEHEAD.

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EUSTACHIAN OBSTRUCTION AND CHRONIC NON-SUPPURATIVE MIDDLE EAR DISEASE.

Catarrhal swelling of the mucous membrane of the Eustachian tube is the first stage in the process; the tube is closed and the oxygen in the air contained in the tympanic cavity and mastoid antrum is absorbed into the blood. We thus have a diminution in the air pressure in the middle ear cleft whilst a hyperæmia *ex vacuo* occurs in the mucous membrane, and is followed by a transudation of clear yellow serum into the cavities. The tympanic membrane is pushed inwards by the greater air pressure acting on the outer surface of the tympanic membrane.

In the second stage the catarrhal process spreads up from the Eustachian tube and the serum in the tympanic cavity becomes cloudy from admixture of white blood cells; the tympanic membrane becomes opaque and loses its polish and may be slightly bulged outwards by pressure of the accumulated secretion. This stage may last for a considerable time.

If recovery does not occur the case may end in one of two ways:

(1) *Chronic Catarrhal Otitis Media.*—The Eustachian obstruction continues and, although the secretion in the middle ear cleft is partially absorbed, the mucous membrane remains permanently thickened and the tympanic membrane indrawn; adhesions may form between the membrane and the inner wall of the tympanic cavity and ossicles. The tendon of the tensor tympani muscle is permanently shortened; calcareous deposits may form in the tympanic membrane.

(2) *Dry Catarrh of the Middle Ear or Oto-fibrosis.*—In a few cases, owing to excessive absorption of the inflammatory material, the Eustachian tube becomes unduly patent and the membrane thin and atrophied in parts.

Functional Tests.—Bone conduction is lengthened, *i.e.*, the patient hears a tuning fork pressed on the vertex after a normal person has ceased to hear it. Low tones are badly heard. A tuning fork placed on the vertex is heard best in the affected (or worse) ear. On the other hand, high tones are well heard and a watch is heard when pressed on the forehead or mastoid process. It is very important to test the hearing distance of each ear for the ordinary and whispered voice before commencing treatment and to take a note of the result.

Prophylaxis.—It is impossible to lay too much stress on the importance of early treatment in cases of Eustachian obstruction before the tube has become permanently narrowed and the tympanic membrane indrawn and perhaps fixed in its abnormal position. The prognosis in early cases is very favourable, whereas in those of ten years' duration little or nothing can be done. In this connection we may hope for considerable improvement in the years to come from recent legislation in regard to the medical examination of school children and its natural consequence—the early treatment of cases of nasal obstruction and catarrhal deafness. It is very important that all cases of deafness in children, even if the deafness is only occasional, should receive prompt attention and that the cases should not be allowed to pass from observation until normal hearing has been restored.

Treatment may be classified as follows:

I. General Treatment. II. Treatment of Nasal and Naso-pharyngeal Catarrh and Obstruction. III. Treatment of the Middle Ear: (*a*) Establishing the patency of the Eustachian tube; (*b*) medication of the mucous membrane of the middle ear cleft by vapours and solutions; (*c*) restoring the mobility of the membrane and ossicles; (*d*) intra-tympanic operations. IV. Symptomatic Treatment: (*a*) Tinnitus; (*b*) Deafness.

I. GENERAL TREATMENT.

Under this heading we may include the question of climate. It is generally admitted that high altitudes (Davos and Pontresina) and dry climates (Egypt) are best suited for cases of chronic catarrhal otitis media; unfortunately few are able to adopt this line of treatment. It is also important to limit the amount of alcohol and tobacco and to attend to the patient's digestion. In regard to drugs, small doses of potassium iodide are sometimes given to promote absorption of exudation.

II. NASAL AND NASO-PHARYNGEAL CATARRH AND OBSTRUCTION.

Free nasal respiration is essential to keep the naso-pharyngeal mucosa in a healthy condition, and we may say therefore that all cases of nasal obstruction should be dealt with. On the other hand, it is impossible, in a case of advanced chronic middle ear catarrh, to promise any improvement inhearing from intranasal treatment.

If the case is one of comparatively short duration, say one or two years, and if the patient does not suffer from marked tinnitus, and finally, if the hearing power improves markedly after a successful inflation, we may say that an intranasal operation will probably do good and that at any rate it is the best chance of avoiding further deterioration in the hearing. If, on the other hand, the deafness and tinnitus have lasted for many years, and if there is little or no improvement after a successful inflation, it is better not to interfere, or, at any rate, to tell the patient that operation will give him free nasal respiration but is very unlikely to benefit his hearing. The intranasal conditions usually associated with chronic middle ear catarrh are:

(*a*) Chronic hypertrophic rhinitis. (*b*) Chronic muco-purulent nasal catarrh and chronic naso-pharyngeal catarrh. (*c*) Adenoid post-nasal growths. (*d*) Adhesions in the naso-pharynx. (*e*) Tumours of the naso-pharynx.

(*a*) **Chronic Hypertrophic Rhinitis,** with or without deflection of the nasal septum. For the detailed treatment of these conditions the reader is referred to the article dealing with these subjects, but it may be shortly stated that the first line of treatment is the use of an alkaline nose wash along with a menthol inhalation: ℞. Sod. Bicarb., Sod. Biborat., āā ℥j; Sod. Chlorid., ℥ij. *Sig.:* One teaspoonful in a cup of lukewarm (sterile) water to make the lotion for the nose. The lotion may be sniffed up (night and morning) from the teacup or may be used with one of the numerous nasal irrigators at present on the market: ℞. Mentholis, ʒij. *Sig.:* A pinch of the crystals in a pint of hot water for each inhalation. The patient should be recommended to use a quart jug, into which he puts a pint of boiling water; after waiting five minutes he adds a pinch of the menthol crystals and inhales at intervals.

If this treatment fails, and if the inferior turbinals are large and congested, it is better to apply a 10 per cent. solution of cocaine on cotton-wool tampons; if the swelling goes down to any considerable extent the electro-cautery may be used with every prospect of a good result; but if the swelling of the turbinals does not subside the condition is one of chronic inflammatory œdema, and turbinectomy is indicated. Enlargement of the posterior ends of the inferior turbinals is specially likely to cause Eustachian obstruction.

(*b*) **Chronic Muco-purulent Nasal Catarrh and Chronic Naso-pharyngeal Catarrh.**—The nose wash and menthol inhalation given above should be used, but in many cases it is advisable to use the former with the aid of a douche can, or Higginson's syringe, to which a nasal nozzle is attached. The patient should be instructed to lean forward over a basin and to breathe through the mouth during the lavage, and the nozzle of the syringe should always be inserted into the more obstructed of the two nostrils. After lavage the mucous membrane may be painted with a 1 per cent. aqueous solution of silver nitrate or with the iodine paint mentioned later.

(*c*) **Adenoid Post-nasal Growths.**—Many writers insist on the necessity for the removal of even the smallest trace of "adenoids" in cases of middle ear catarrh. There can be no doubt that in those cases where the adenoid growth is considerable an operation should be undertaken, but the writer has never been able to convince himself that any useful purpose is served by the removal of a mere trace of adenoid tissue in the vault of the naso-pharynx. If, however, the fossæ of Rosenmüller behind the Eustachian cushions contain adenoid growths, it is probably better to operate in order that there may be no mechanical impediment to the opening of the Eustachian tubes during the act of swallowing.

(*d*) **Adhesions in the Naso-pharynx due to Former Operations or to Ulcerative Processes.**—Packard advises the breaking down of such adhesions by the insertion of the finger behind the soft palate, as in the digital examination for "adenoids."

(*e*) **Tumours of the Naso-pharynx.**—It is remarkable how seldom naso-pharyngeal fibromata give rise to Eustachian obstruction, although they are much larger than any mass of adenoids. This appears to the writer to negative the view that adenoids act mechanically, and to support the contention that the catarrhal condition of the mucosa associated with these growths ("adenoids") is the real cause of tubal closure in such cases.

III. TREATMENT OF THE MIDDLE EAR.

(*a*) **Establishment of Patency of Eustachian Tubes.**—This is by far the most important factor in the treatment of middle ear catarrh; unfortunately, it is by no means easy. The mucous membrane of the tube is swollen and œdematous, and in many cases an infiltration of small cells is present under the superficial epithelium. In recent cases the narrowing is situated near the pharyngeal orifice, but in chronic cases extends to the isthmus. The tympanic membranes should be inspected, and the hearing distance tested before and after inflation. It must be emphatically stated that the following methods are of no avail if the inner ear is found to be affected on functional examination (*see* article on

Nerve Deafness). There are three methods of inflating the middle ear cleft.

(i.) *Valsalva's Experiment.*—The patient takes a deep breath, closes the mouth and occludes the nostrils with the forefinger and thumb, and then forcibly blows out the cheeks. As the air cannot escape by the nose and mouth, it is forced into the middle ear cleft, unless the Eustachian tubes are markedly narrowed. Unfortunately, in cases of chronic tubo-tympanic catarrh this easy method is seldom successful, but in cases where it can be carried out the patient must be warned against its too frequent use; once a day is quite sufficient.

(ii.) *Politzer's Method* takes advantage of the fact that the Eustachian tube is opened during the act of swallowing; this method is especially suitable for children. The operator connects his ear to that of the patient by means of the otoscopic tube. The patient then takes a mouthful of water, but is instructed not to swallow it till the signal is given; the nozzle of a Politzer bag guarded by a piece of rubber tubing is now tightly inserted into one of the patient's nostrils, and the other nostril is compressed by the left hand of the operator so that there shall be no escape of air. The signal to " swallow " is now given, and, as the larynx rises, the bag is forcibly squeezed so as to force a current of air into the middle air clefts. As a rule, the operator hears the air enter the tympanic cavity, but, if not, inspection of the tympanic membrane will clear up the question of the success of the inflation. Children are often too frightened to swallow water, but " crying " serves the same purpose. This proceeding should be repeated every second day till the tympanic membrane retains the normal curvature and the hearing distance becomes normal.

(iii.) *The Eustachian Catheter.*—These instruments are made of vulcanite or of metal; Nos. 1 and 2 are the most useful sizes. It is important to attend to antiseptic precautions, and for this reason metal catheters are the safest, as they can be sterilised by heat; vulcanite catheters should be kept in a jar of carbolic lotion (1—20), but thoroughly dried before use by blowing through them a stream of air and wiping the outer surface with a sterilised cloth. Before passing the catheter it is advisable to make an anterior rhinoscopic examination, and, if the nasal passage is narrow and the patient very sensitive, it is well to anæsthetise the inferior meatus by means of a cotton-tipped probe dipped in 10 per cent. cocaine solution. The otoscopic tube is again used, and the Politzer bag is at first held in the left armpit of the surgeon. The tip of the patient's nose is tilted upwards with the thumb of the surgeon's left hand and the catheter, beak downwards, is inserted into the nostril with the right hand. The instrument is now gently pushed backwards, keeping the beak in contact with the floor of the nasal cavity until the distal end of the probe is felt to come in contact with the posterior wall of the naso-pharynx. The catheter is now turned through an angle of 90 degrees, so that the ring on the proximal end, which indicates the direction of the beak of the catheter, looks towards the other ear of the patient. The catheter is now withdrawn till the beak is felt to touch the posterior border of the nasal septum, when the catheter is rotated downwards through slightly more than two right angles, until the ring now looks towards the outer canthus on the same side. The catheter is then held in position between the forefinger and thumb of the surgeon's left hand, the other fingers resting lightly on the patient's nose. The nozzle of the Politzer bag is next inserted into the mouth of the catheter and the bag forcibly compressed with the surgeon's right hand. As a rule, the air will be heard to enter the tympanic cavity, but in cases of marked swelling of the lining membrane of the tube, even this procedure fails. In some cases distant coarse râles are heard due to mucous accumulation in the pharyngeal end, while in others a high-pitched squeaking noise occurs due to stricture higher up in the tube. Occasionally a coarse bubbling noise may be heard due to air entering a tympanic cavity which contains mucous exudation. In all cases the tympanic membrane should be inspected after the use of the catheter, and the hearing distance again tested. After a successful inflation, especially in early cases, it is usual to find a very marked improvement in the hearing distance, but it is right to tell the patient that this is not permanent and that he may expect the deafness to return. One or other of these procedures should be repeated every second day until the maximum improvement has been obtained.

Eustachian Bougies.—If the catheter fails, it is advisable to attempt to restore the patency of the Eustachian tube by means of bougies. These instruments are usually made of celluloid and are therefore liable to become brittle, so that it is advisable to test their elasticity before use. The sterilised bougie of suitable size is first passed along the catheter till the end appears at the beak of the latter instrument; the distance is marked off with the thumb nail and the bougie is then withdrawn and an ink mark made at the spot indicated; a second ink mark is next made 2 centimètres behind the first, as this is the distance between the pharyngeal orifice of the tube and the isthmus or narrowest portion. The catheter is now placed in position as described above and the bougie is passed through it till the foremost mark disappears and then gently pressed onwards till the second mark is also covered; no force must be used. If the bougie is in the correct position the catheter need no longer be held by the operator, as the bougie in the tube will retain it in place. The bougie should be left in position for five minutes and then gently withdrawn and air inflated. If there is blood on the bougie inflation should not be practised. Before passing the bougie this instrument may be dipped in the following ointment: Hydrarg. Oxid. Rub., gr. 4; Lanolin, gr. 100; Paroleine, ℥j (Lake); or, Iodine, gr. 6; Pot. Iodid., gr. 12; Aquæ, ʒij; Ol. Menth., Pip., ♏2; Glycerinum, ad ℥j (Gray).

Electrolysis of the Eustachian Tube has been recommended by Duel. The Eustachian bougie is made of gold and the negative pole is attached to it. The + or positive electrode is held in the patient's hand. The current is from 3 to 5 milliampères and the voltage should not exceed 40. The results are no better than with the ordinary bougie.

If no improvement in the hearing distance be obtained after two or three sittings it is no use to persevere further with the catheter and bougie.

In cases with fluid exudate into the tympanic cavity one or two successful inflations are usually sufficient to set up absorption; but if these fail it is useful to try the effect of a blister (painting with liquor epispasticus) over the mastoid process; if this is not successful it may be well to perform paracentesis of the tympanic membrane in the following manner: The external auditory meatus is first of all syringed out with lukewarm lysol solution (1 drachm to a pint of sterile water) and then dried out carefully with antiseptic cotton-wool under the control of a good light reflected into the meatus. A pledget of cotton-wool soaked in the following solution is next placed against the tympanic membrane and allowed to remain in position for ten minutes: ℞. Acid. Carbol., Cocain. Hydrochlor., āā gr. 15; Adrenalin Chlorid., ♏15; Spirit. Vini Rect., ʒij. The pledget is withdrawn and an incision is made in the posterior inferior part of the tympanic membrane radiating from the umbo of the malleus towards the periphery. The middle ear is now inflated in order to drive out the exudate, and finally a little dry finely-powdered boric acid is insufflated against the tympanic membrane. Gray states that suppurative otitis media not infrequently follows this proceeding, but adds that the operator need not blame himself when this occurs. Bryant records two cases of chronic catarrhal otitis media in which the hearing improved after an intercurrent attack of acute purulent otitis media and mastoiditis; the mastoid operation was performed. Halherbe has recommended a modified radical mastoid operation in cases of chronic middle ear catarrh, but this line of treatment has not met with approval.

(*b*) **Treatment of the Mucous Membrane of the Eustachian Tube and Tympanic Cavity by means of (i.) Medicated Vapours, and (ii.) Solutions.**—(i.) If the Eustachian tube is fairly patent, Valsalva's method may suffice: ℞. Tinct. Iodi., Ether. Acetic., āā ℥ss. [U.S.P. ℞. Tinct. Iodi. ʒj ♏20, Ether. Acetic., ℥ss; Alcohol, ad ℥j.] *Sig.:* Half a teaspoonful of the solution to be inhaled from a jug of hot water (160° F.). The patient is instructed to perform Valsalva's experiment on one or two occasions during the process of inhalation.

If the tube is too narrow to allow of the above method, the catheter is passed in the usual way and air is inflated to ascertain that the tube is more or less patent. The Politzer bag is then compressed and the nozzle inserted into a bottle which contains a little of the fluid, the vapour of which we desire to use; the bag is then allowed to expand and its nozzle is fitted into the mouth of the Eustachian catheter; pressure is applied in the hope that the vapour will pass up the Eustachian tube and enter the tympanic cavity. The following vapours may be used in this way: Ol. Eucalypti, Ol. Pini Sylvest., āā; Acetic Ether, Chloroform and Turpentine. A few drops of iodide of ethyl may be placed in the Politzer bag and allowed to volatilise before inflation. Bronner advises a compressed air apparatus for medicating the mucous membrane of the middle ear cleft. Ferran recommends the inhalation of hot air twice weekly. The apparatus consists of a Politzer bag with an aluminium connection in which an electric lamp is placed; on turning on the current a heat of 70° to 80° F. is obtained in a few minutes.

(ii.) For the injection of solutions a Pravaz syringe is used; this instrument is very like the ordinary hypodermic syringe except that its nozzle exactly fits the Eustachian catheter. After the catheter has been passed and held in position, 2 to 4♏ of the desired fluid are drawn up into the syringe and injected into the catheter; the syringe is then withdrawn and the fluid injected up the Eustachian tube by means of the Politzer bag. The following solutions have been used: Sodium Bicarbonate (saturated solution); Potassium Iodide (ʒj to ℥j); Nitrate of Silver (½ per cent.); Liquid Vaseline; Dionin (5 per cent. solution).

(*c*) **Massage of the Tympanic Membrane and Ossicles.**—This may be carried out in several ways:

(i.) The patient closes the external meatus by pressing the tragus against it with the tip of the forefinger and then by a series of rapid in-and-out movements of the finger alternately raises and lowers the air pressure in the external meatus. According to Schwartze, this method is just as efficient as the use of expensive instruments.

(ii.) *Siegle's Speculum.* — The nozzle of this instrument is covered with rubber tubing and after the bulb has been compressed it is fitted tightly into the external meatus; the bulb is now released and again squeezed as rapidly as possible. By inspecting the tympanic membrane through the glass which closes the speculum it is possible to observe the effect produced on the membrane and malleus.

(iii.) *Delstanche's Otomasseur* acts in a similar way; the piston stroke should not be more than ¼ inch. As these instruments may cause rupture of the membrane and hæmorrhage, we should be very cautious in entrusting them to the patient's own use.

(iv.) *Otomasseurs* driven by hand or by electricity. By these instruments a velocity of from 100 to 3,000 per minute may be obtained.

(v.) *Lucae's Pressure Probe.*—This instrument is fitted with a small cup-shaped end piece to fit the short process of the malleus; the shaft of the instrument contains a delicate spring to avoid excessive pressure. It is best to give the patient a general anæsthetic as the proceeding is extremely painful. Under illumination the end of the probe is fitted over the short process of the malleus and rapid pressure is exerted from the wrist.

Since the introduction of *fibrolysin*, attempts have been made to use this drug in the treatment of chronic middle ear catarrh in conjunction with the catheter and massage of the membrane and ossicles. Gay French injects 30 min. subcutaneously and inflates 5 min. into the Eustachian tube through the catheter in the method described above. After waiting fifteen minutes he then applies massage. The treatment is carried out twice weekly. The results are not brilliant, though there may be a temporary improvement.

(*d*) **Intra-tympanic Operations.** — These are now generally discarded: formerly attempts were made to produce and maintain an artificial opening in the tympanic membrane; in addition, division of the posterior fold of the membrane, tenotomy of the tensor tympani, division of adhesions between the membrane and inner wall of the tympanic cavity, removal of the membrane along with the malleus and incus, and extraction of the stapes, have all been tried and given up.

In some cases it appears that the absorption of the inflammatory material has been excessive and the Eustachian tubes become unduly patent. The patients find out for themselves that Valsalva's experiment improves the hearing and they accordingly employ this method too frequently and too forcibly; it must be remembered that in these cases the membrane is atrophied, at any rate in parts, and has lost much of its elasticity. The result is that on inflation the membrane bulges outwards like a sail in the wind. In these cases the following methods of treatment are employed: (i.) Incision through the atrophied portion in the hope that cicatrisation will result in contraction; (ii.) painting the membrane with collodion after inflation; the collodion film dries and may act as a support to the relaxed membrane; (iii.) recently Heath has advised that the membranes should be painted with blistering fluid mixed with tincture of lavender; he employs paints of various strengths; the weakest is 1 part of liquor epispasticus to 6 of tincture of lavender, while the strongest consists of equal parts of these two fluids. Heath recommends that the painting treatment should be carried out daily for two months, and patients must be forbidden to blow their noses during this period.

IV. SYMPTOMATIC TREATMENT.

For the treatment of deafness and tinnitus the reader is referred to the writer's article on Otosclerosis, pp. 955—6.

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OTOSCLEROSIS.

Syn.—Chronic progressive deafness; Osteitis stapedio-vestibularis.

The anatomical basis of this disease is a bony ankylosis of the stapedio-vestibular joint. There are two views as to the pathology of the condition: (1) The disease commences in the bony capsule of the labyrinth, especially in the region of the oval window (Politzer); (2) the condition originates in the mucous membrane of the middle ear but is specially localised to the region of the oval window (Habermann). The condition is allied to that found in arthritis deformans, and we may say that it is now regarded as a local manifestation of a general toxic condition.

Prognosis.—It is advisable to tell the patient that the tinnitus and vertigo are not due to brain disease and that the ear disease is not fatal and does not even lead to absolute deafness; further, that there are as a rule long periods during which the disease does not advance. We must confess that in other respects the prognosis is bad; patients should be encouraged to ignore as far as possible the noises in the head and may be informed that in time the tinnitus will become less although the deafness may increase. (Married women should be informed of the prejudicial effect of pregnancy on the ear disease.)

Prophylaxis.—Körner advises against marriage in the case of patients suffering from otosclerosis.

TREATMENT.

Treatment may be divided into: (1) General; (2) Local; and (3) Symptomatic.

General Treatment is most important; as before stated, the disease is now looked on as a local manifestation of a general toxic condition. Siebenmann recommends phosphorus and states that this drug can arrest the course of rapidly progressing cases and improve the tinnitus; phosphorus should be prescribed in pills in doses of $\frac{1}{60}$ gr. or in capsules in the form of oil of phosphorus. Politzer recommends sodium iodide (8 to 15 gr. in the day for twenty-five to thirty days); this treatment should be carried out two or three times a year in cases in which the otosclerosis is not as yet far advanced. Schwartze advises mercurial inunctions in cases of supposed syphilitic origin. Lake recommends the injection of mercurial ointment combined with the use of otomassage: ℞. Hyd. Biniod., gr. 16; Lanolin, ʒvij; Ol. Pot., ad ℥iv, M. *Sig.:* Warm and inject 3 min. into the middle ear along the Eustachian catheter.

In addition to the above remedies, strychnine, arsenic, and iron preparations have all been recommended, especially in cases associated with anæmia and debility. Thyroid tabloids were at one time advocated but have not been found to do good, while bad results were reported in some cases. A restricted dietary similar to that employed in cases of arterio-sclerosis has also been advised. In cases occurring in stout plethoric individuals Turkish baths may be of benefit, and a course of treatment at Carlsbad or Wiesbaden may be recommended in the same class of case.

The writer is in the habit of prescribing syrup of the glycerophosphates with strychnine; one teaspoonful thrice daily after meals. It must be confessed that the treatment of otosclerosis, whether general, local, or symptomatic, is extremely unsatisfactory.

Local Treatment.—It is better to avoid local treatment altogether. When once the diagnosis of otosclerosis has been made it is useless to inflate air or medicated vapours along the Eustachian tube, to massage the tympanic membrane and ossicles by means of the otomasseur or Lucae's pressure probe, or to attempt to mobilise or extract the stapes. Treatment by inflation and massage is founded on a wrong view of the pathology of the disease in that otosclerosis is confused with Eustachian obstruction and chronic middle ear catarrh. Extraction of the stapes without fracture of the crura is almost impossible in cases in which the footplate is firmly joined by new formed bone to the edge of the oval window. In any case the improvement which follows extraction of the stapes soon gives place to marked and rapid deterioration of the hearing.

Symptomatic Treatment.—(1) *Tinnitus* is often more troublesome to the patient than deafness. Potassium bromide and potassium iodide (āā 5 gr.) may be ordered in a mixture thrice daily. In these cases the writer is also in the habit of painting the bare pear-shaped area of skin over the mastoid process with liquor epispasticus; it is well to smear the skin around this area with vaseline to prevent the blistering fluid running where it is not wanted. When the bleb rises it should be clipped with a pair of sterile scissors and the raw surface covered with vaseline. Sacher recommends pills of corrosive sublimate. ℞. Hydrarg Perchlor., gr. 1; Extract. Gentian., q.s. *Sig:* Make a pill mass and divide into sixty-four pills. One pill twice daily after meals. As a rule, considerable improvement is experienced at the end of the first month, but it is well to continue the treatment for two months before rejecting it as useless. Sacher states that this treatment does not influence the deafness. Hunter Tod recommends the use of digitalis in cases of pulsating tinnitus, even in the absence of a cardiac lesion.

Hydrobromate of quinine may be given in tabloids in doses of 3 gr. twice daily, but it is difficult to forecast the effect of this drug, which should be stopped at once if the tinnitus is made worse.

The galvanic current has been used in the treatment of tinnitus; the positive pole is applied in front of the ear and the negative pole is placed on the back of the neck. The current is commenced at zero and increased up to 3 milliampères; it should be again reduced to zero before shutting it off; the sitting lasts two or three minutes.

Lumbar puncture has been recommended by Babinski in the treatment of tinnitus and vertigo, but the writer has no experience of this method in such cases.

In severe cases where the incessant noises appear likely to lead to insanity or suicide one may discuss the question of section of the auditory nerve at the internal meatus or of extirpation of the labyrinth (Lake).

(2) *Deafness.*—It is advisable as soon as the deafness becomes at all marked that the patient should learn to lip-read; regular lessons in lip-reading may be obtained in most of the larger towns, but even if these are beyond the means or the reach of the patient a great deal may be learned by attentively watching the lips of the people with whom the patient is conversing.

Artificial aids to hearing may be divided into three classes: In (*a*) the sounds are conducted directly to the inner ear through the cranial bones by means of a curved plate held against the teeth (the dentophone); the inner ear must be intact for this instrument to be of use. (*b*) The sound is collected in a large receiver and conveyed to the ear partly by air and partly by bone conduction; in this class we have the various forms of ear trumpet. (*c*) The sound is transmitted to the ear on the principle of the telephone; the instrument consists of a receiver, an electric battery, and an ear piece with the usual connecting wires: patients who can hear well by the ordinary telephone may expect to find this instrument of use.

The best advice to give the patient is to try the different appliances at the instrument maker's shop and to deposit a sum of money for a week's trial of the instrument he finds most suitable; as a rule, the makers are quite willing to let patients have any of the appliances on these terms.

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ACUTE DISEASES AND SUPPURATION OF THE LABYRINTH.

Until recent years much confusion and lack of exact knowledge existed with regard to the diseases of the labyrinth. Their pathology was vague, and diagnostic methods were inadequate for the differentiation of the numerous conditions met with. The infective conditions of the labyrinth and their antecedents in particular had escaped proper notice, with the result that they failed to obtain due recognition as the causes of some of the most serious complications of aural suppuration. Modern investigations into the pathology of the labyrinth have thrown most important light on the causation of meningitis and cerebellar abscess, and have opened the way to the successful operative treatment of infective labyrinthitis. The detailed treatment of diagnostic methods is outside the scope of the present work; the methods themselves we owe to the Vienna School, and particularly to the work of Bárány. British otology may claim its share in the development and simplification of the operative treatment of diseases of the labyrinth.

Paroxysmal Labyrinthine Vertigo.—This symptom is common to a large and mixed group of clinical conditions, both non-infective and infective. Their resemblance to the classical Menière's symptoms has led to confusion. Their differentiation is, however, of great importance, as successful treatment depends on accurate diagnosis.

PAROXYSMAL VERTIGO OF VASOMOTOR ORIGIN.

This occurs chiefly in middle-aged men, otherwise as a rule in apparently good health. There is not typically any marked arterio-sclerosis. The symptom probably arises from a cumulative auto-intoxication, and is closely related to migraine. The attack is very sudden, so that the patient may fall like an epileptic. He is often quite incapacitated, though consciousness is never lost. Vomiting may follow within a few minutes. The vertigo is at first intense, gradually diminishing and disappearing in a few hours or days. It is sometimes anticipated by a feeling of fulness and discomfort or by an increase in tinnitus. During the paroxysm there is marked deafness, both for perception through air and through the cranial bones. This is usually recovered from to a greater or less degree. Attacks may continue over a long period, but tend to wear themselves out with time. Hearing is generally much damaged in the process.

The existence of a true epilepsy with an aura of vertigo must be excluded, as must also infective conditions of the middle ear, either past or present. In the typical case the otoscopic appearances throw no light on the origin of the attacks; tests of the functional activity of the vestibular section of the labyrinth show a normal or diminished excitability, both to thermal and rotatory stimulation, according to the amount of damage which has been sustained by repeated attacks.

Treatment.—In the great majority of cases, treatment on medical lines proves entirely satisfactory. A survey of the patient must of course be made, and any general condition, such as gout, must be taken into account and treated. As a rule, however, nothing of significance comes to light. When the case is uncomplicated, the two drugs of value in securing relief are mercury in the form of blue pill and iodide of potassium. The following prescriptions are suitable: ℞. Pil. Hydrarg., [U.S.P. ℞. Mass. Hydrarg.] gr. 1 to 2 om. noct.; ℞. Pot. Iod., gr. 10; Ammon. Carb., gr.2; Aq. Chloroformi, ℥j [U.S.P. ℞. Pot. Iod., gr. 10; Ammon. Carb., gr. 2; Aq. Chloroformi, ʒss; Aq., ad ℥j] ter. die post cib.

Free intestinal evacuation must be secured; as a rule, after the first week the pill may be given every other night. The course of treatment should be continued for three weeks. A somewhat light diet should be ordered, with not much red meat; strong tea and alcoholic drinks should be entirely forbidden; tobacco may be allowed in strict moderation. As a rule, under such treatment the attacks of vertigo quickly become less severe and less frequent, and may disappear permanently if a prudent regimen is adhered to in the future. Any reappearance should be met by the return to strict treatment.

In very exceptional cases the attacks are not materially influenced by medical treatment. These probably form a class of different pathology, the exact nature of which is unknown. It is often possible in these cases to assign the origin of the vertigo definitely to one labyrinth, and it is justifiable in such cases, after the failure of medical treatment, to put a stop to the vertigo by operation on the labyrinth at fault. Such a course should only be considered in the worst cases, in which the patient is incapacitated. It should be borne in mind that the condition tends to die out with time, that operation will permanently destroy the ear as a functional organ, and that there is no guarantee that the other ear may not subsequently enter on similar changes. When operation is determined upon a "double vestibulotomy" is a sufficient and successful operation. For an outline of this operation *see* p. 962.

PAROXYSMAL VERTIGO ASSOCIATED WITH MIDDLE-EAR SUPPURATION, BUT WITHOUT GENERAL INFECTION OF THE LABYRINTH.

Vertigo occurring in connection with middle-ear suppuration, past or present, is always a symptom of importance. In the absence of general infection of the labyrinth (*see* pp. 961—2) it may be due to erosion of the bony wall of the external semicircular canal without opening of the lumen of the canal; to abnormal mobility or erosion of the footplate of the stapes; or to the presence of a fistula of the external semicircular canal. The differential diagnosis of these three conditions is difficult and is not always possible. A definitely positive "fistula sign" (*i.e.*, the production of forced ocular movements, nystagmus, and vertigo by condensation and rarefaction of air in the external auditory meatus) leaves no doubt of the presence of this lesion, but many cases of fistula of the canal do not yield it. In all cases operative treatment should be undertaken without delay. The exact anatomical condition is discovered at the time of operation. Cases of this group give responses of normal type, with or without impairment of intensity, to both thermal and rotatory tests, and are thus differentiated from cases of general labyrinthine infection. When the impairment of the response to rotation is great the response to thermal stimulation may fail entirely. Such cases are always examples of fistula of the labyrinth, and should give an unequivocal fistula sign on compression and rarefaction of air in the meatus. When spontaneous nystagmus is present it is almost always to the side of the affected ear, the sensation of the patient being of the passage of objects to the opposite side. Rarely, however, a spontaneous nystagmus is met with to the opposite side and rotatory in character. If response to tests is entirely absent the question of vestibulotomy may have to be very carefully weighed at the time of operation, and decided by the condition found.

Treatment.—This should be by the radical mastoid operation, or in suitable cases of chronic attic suppuration by the epitympanomastoid operation. If the labyrinth is known to be functional, a fistula of the external semicircular canal should be left entirely without interference. On no account should a probe be passed into it. In many of these cases the fibrous periosteal lining of the bony canal is intact; in all the labyrinth is capable of healing without operative treatment. Grafts may be used in these cases, but owing to the risk of closing up drainage from the local infection great care must be taken to avoid the covering of the fistula with the graft. In all other respects the cases must be treated on the same lines as ordinary radical mastoid operations.

Fistulæ of the ampullæ are probably in all cases associated with infection of the vestibule, and if such a condition is encountered unexpectedly the best treatment is by double vestibulotomy (*see* p. 962, and also under Chronic Suppuration of the Labyrinth, p. 964).

PAROXYSMAL VERTIGO ASSOCIATED WITH PAST DESTRUCTION OF ONE LABYRINTH.

When one labyrinth undergoes functional destruction there is for a time a condition of unbalanced and uncompensated stimulus from the surviving side, which may express itself in the sensation of vertigo. This condition disappears in a variable time, more quickly in young subjects than in old. The acquired compensation is liable to be upset by subsequent illness, and particularly by conditions which rapidly alter the force and rate of the heart-beat. Thus, severe paroxysms of vertigo may result from running up a flight of stairs or from any sudden and forcible exertion. Spontaneous nystagmus is present during the attack; it is to the side opposite the lesion, and is of a rotatory downward and outward type. The usual reactions to rotation and thermal stimulation are entirely absent on the side affected and this ear is totally deaf.

In the majority of cases the symptoms merely call attention to a condition of chronic suppuration of the labyrinth, under which heading the treatment proper to this condition will be found. In cases in which there is no present suppuration, treatment must be on medical lines. Rest, light diet, and a course of moderate aperients, *e.g.*, Friedrichshall, will generally prove adequate, and the patient should be warned to avoid the conditions which have excited or are likely to excite attacks. When the vertigo is persistent relief may generally be obtained by the use of hydrobromic acid and quinine, *e.g.:* ℞. Acid. Hydrobrom. Dil. ♏30; Ammon. Brom., gr. 10; Quin. Hydrobrom., gr. ss; Aq. Chloroformi, ad ℥j; [U.S.P. ℞. Acid Hydrobrom. Dil. ♏30; Ammon. Brom., gr. 10; Quin. Hydrobrom., gr. ss; Aq. Chloroformi, ℥ss; Aq., ad ℥j] quartis horis sumend.

ACUTE INFECTIVE LABYRINTHITIS.

Acute infection of the labyrinth is almost always secondary to infective disease of the middle ear, generally of chronic character; rarely it may be due to extension of infection from the basal meninges through the internal auditory meatus, or to a blood infection. When spreading from the tympanum, infection may pass either through one of the windows, commonly the oval, or through a fistula of the canal region. When acute labyrinthitis is secondary to an acute otitis media, infection appears to take place usually through the substance of the membrana secundaria without perforation of this structure. Acute labyrinthitis is always diffuse, involving the whole of the interior of the labyrinth and speedily destroying it as a functional organ.

The symptoms are sudden intense vertigo, with pain in the affected ear and in the side of the head and spontaneous nystagmus. Vomiting usually occurs early; there is some elevation of temperature, to 100° to 102° F. The patient is obviously ill and distressed. The spontaneous nystagmus is, in the earliest stage, to the affected side and horizontal in movement, changing in a few hours to the sound side, with a rotatory motion downwards and outwards. There is danger in these cases of infection extending either to the meninges or to the cerebellum; in the latter case, in addition to other symptoms, the nystagmus again changes in type, becoming a coarse oscillation, horizontal, and almost always to the affected side. In acute infective labyrinthitis the ear is totally deaf, and no response can be elicited by either thermal or rotatory methods of stimulation. The patients are, however, too ill to be suitable for the application of prolonged and tedious methods of diagnosis, and the condition may be identified with certainty without recourse to the elicited forms of nystagmus.

An immediate radical mastoid operation should be performed, followed by the operative opening of the vestibule; whether inferior or double vestibulotomy be used must be decided by the anatomical conditions found. Only by drainage of the vestibule can the risk of intracranial spread of infection be prevented. The relief given to the patient by operation is at the same time very striking; pain and headache disappear, and the temperature falls. There is also generally an almost immediate disappearance of the vertigo, though this is difficult to explain theoretically.

THE OPERATIONS OF INFERIOR AND DOUBLE VESTIBULOTOMY.

These operations are designed to give free drainage in cases of infective labyrinthitis. Double vestibulotomy is also a suitable and adequate operation in those occasional non-infective cases of obstinate severe labyrinthine vertigo which fail to show amelioration under medical treatment. The performance of a carefully executed radical mastoid operation is a necessary preliminary to either procedure, and the posterior wall of the osseous meatus must be completely removed to provide a good view of the inner wall of the tympanum.

In inferior vestibulotomy the outer wall of the vestibule, comprising the area of the fenestra ovalis and the posterior part of the promontory which lies between this and the fossula rotunda, is opened up. In double vestibulotomy, in addition, the vestibule is opened above the tympanic part of the facial nerve by the removal of its roof and the ampullæ of the bony superior and external semicircular canals.

If the operation is undertaken for labyrinthine infection, inferior vestibulotomy is the operation of choice when the point of entrance of infection lies below the facial nerve, *i.e.*, either through the footplate of the stapes, the fossula rotunda, or the promontory. Only when infection has made its way through the region of the semicircular canals is it necessary to remove the wall of the vestibule in this part also for the purpose of getting rid of diseased bone in this region. These operations demand very special skill and technical knowledge; the facial nerve runs great risks from the slightest uncertainty of anatomical precision or delicate accuracy in the removal of bone. If the fundus of the internal auditory meatus is opened through the vestibule there is necessarily danger of infective meningitis. Special small gouges and chisels are used for the removal of the outer wall of the vestibule, and suitably shaped curettes may be required to remove granulations from its interior. Good illumination is necessary for the safe conduct of the operations, and is best secured by a head-lamp.

In acute infective labyrinthitis it is not always possible to identify with certainty the point of entrance of infection. If the diagnosis has been properly carried out the operation should none the less be proceeded with, inferior vestibulotomy being sufficient. In these cases the point of entrance has been shown by Scott to be through the membrana secundaria of the round window. If the temperature is materially raised, if the patient is ill and there is or has recently been severe vertigo, if the labyrinth in question is no longer functional, and if there is spontaneous nystagmus of rotatory character to the opposite side, there need be no hesitation over the desirability of securing early drainage for the interior of the labyrinth. Until this is done there is serious danger of spread of infection to the interior of the cranium and resultant meningitis or cerebellar abscess.

The contents of the vestibule in acute infective labyrinthitis are in the early stage a hæmorrhagic fluid which swarms with cocci; later, after two or three days, the vestibule contains yellow pus

After the cavity of the vestibule has been opened it may be disinfected by means of pure izal or formalin applied on the end of a fine cotton-wool swab by means of a probe or aural forceps.

The after-treatment of these cases is on the lines of a radical mastoid operation. No grafting should be done at the time of the primary operation, nor for at least a fortnight from this date. As a rule, these cases do exceedingly well and no unusual troubles occur during the process of healing. There is a strong tendency for the tympanum to be filled up by scar, and this seems to be due to the proliferation of the injured inner tympanic wall. As there is no prospect of hearing, this is not a matter of importance. The packing should be removed after forty-eight hours and the cavity gently irrigated and repacked. Daily dressings should be the rule subsequently and packing should be continued for at least a fortnight.

The results in these cases are very good. The labyrinth has of course been destroyed as a functional organ before the operation, and no recovery of function is to be hoped for. Pain and vertigo are, however, immediately relieved, the period of danger is cut short, and all suppuration ceases. In skilled hands the risk to the facial nerve is very small.

Very rarely cases occur in which there is, in the course of a suppurative otitis media, an attack of acute vertigo with greatly impaired labyrinthine function in both cochlear and vestibular sections, but without serious pain and without fever. Such cases should be very closely watched, but need not be submitted to operation on the labyrinth immediately. If the course of the case is favourable considerable recovery may take place. Presumably they are due to some very attenuated infection or to a non-pyogenic organism, or possibly they may be caused by some inflammatory increase in peri-lymphatic pressure without actual infection of the peri-lymphatic space.

CHRONIC SUPPURATION OF THE LABYRINTH.

This condition is always associated with chronic suppurative otitis media. It is one of the comparatively infrequent and, therefore, little recognised causes of the continuance of a middle-ear suppuration. In many instances there is nothing to direct attention to the labyrinth beyond a high degree of deafness in the affected ear. Unless this is investigated by tuning forks, the significant fact does not appear, viz., that there is total loss of cochlear sensibility. In the great majority of cases there is no complaint of vertigo within recent times, though on careful inquiry a history of a period of intense vertigo at some time in the past is obtainable. Rarely paroxysmal vertigo occurs during the course of a chronic suppuration of the labyrinth on exertion or after illness. Only at these times is spontaneous nystagmus present. Investigation of the vestibular section of the labyrinth by rotation and thermal tests reveals a total loss of excitability.

Chronic suppuration of the labyrinth is important in three ways: from its dangers, which are always present, of the spread of infection to the meninges or cerebellum; from the fact that it is impossible to cure the suppuration by a radical mastoid operation, as the labyrinth remains without proper drainage; and from the fact that operative interference with the ear, which does not include the drainage of the infected labyrinth, is a dangerous procedure, responsible for the majority of cases of post-operative meningitis. As many cases of labyrinthine fistula are met with during operation which have not been suspected beforehand, it is of the greatest importance that the operator should know definitely the functional condition of the labyrinth in each case if he is to come to a proper decision as to the method of treatment. This can only be obtained by the routine testing of all cases before operation.

Vestibulotomy should be performed in these cases. When entrance of infection has taken place through the inner tympanic wall, and the region of the external canal and ampullæ betrays no fistula, inferior vestibulotomy is sufficient. If there is a fistula of the external semicircular canal or of the roof of the vestibule, double vestibulotomy must be performed.

It should be remembered that knowledge that the labyrinth is defunct is necessary to justify interference with a fistula of the external semicircular canal, but that, in this case, operation on the vestibule is distinctly indicated. The cavity of the vestibule is frequently filled by tough granulation tissue, which protrudes through the fistulous opening into the tympanum or aditus; the interior of the vestibule should under these circumstances be gently curetted.

NECROSIS OF THE LABYRINTH.

The capsule of the labyrinth consists of very dense bone, sharply demarcated from the surrounding bone of the petrous. It is liable to necrosis when acutely inflamed or when cut off from its nutrition by being surrounded by disease. Necrosis thus takes place in some of the acutest cases of infective labyrinthitis, and also in cases of tuberculosis of the petrous part of the temporal bone. Necrosed portions of the cochlea exfoliate into the tympanum comparatively easily, and may appear in the external auditory meatus. Sequestra of the canals, however, are largely buried in living bone, and do not become spontaneously discharged. Chronic facial paralysis may cause suspicion of the presence of a sequestrum of some part of the labyrinth in cases of intractable chronic suppuration if tests show a defunct labyrinth in the ear in question; but facial paralysis is by no means invariably present, nor is it necessarily accompanied by disease of the labyrinth. Necrosis of the labyrinth is generally a matter of discovery during operation.

Treatment should always consist of the removal of the necrosed portion, after a roomy radical mastoid operation has been done. Cochlear sequestra can generally be removed by a curette; but those of the posterior section of the labyrinth may require a large removal of bone before they can be extracted. The facial nerve must be carefully preserved, as marked recovery may take place in the facial paralysis. When the nerve is actually involved in the sequestrum, this must be divided so as to release the nerve. The necrosed mass may extend to the upper and posterior aspects of the petrous bone, and may lie against granulating and softened dura mater in these parts. The cavity left by the removal of the sequestrum should be lightly packed with gauze; the after-treatment in its later stages should be like that of a radical mastoid case.

C. ERNEST WEST.

CHRONIC AND NON-SUPPURATIVE AFFECTIONS OF THE LABYRINTH.

ANÆMIA OF THE LABYRINTH.

This is a condition which does not exist as a state peculiar to the labyrinth any more than it does in any other organ; but the labyrinth, in common with them, suffers under certain circumstances from the general anæmic condition; the eighth nerve being particularly liable to asthenic conditions. For this reason, when an anæmic patient suffers from an obvious labyrinthine disturbance, whether this is in the auditory or in the equilibrial parts of the labyrinth, it is perfectly obvious that any attempt to treat the aural affection as a separate entity must lead to unsatisfactory results; and the correct method of attacking the pathological condition of the ear is by relieving the general state of the body. The necessary treatment to obtain this result will be found under that section of general medicine which deals with Anæmia. After this treatment has been carried out, a second examination of the patient should be made in order to ascertain any change in condition and to find out what amount of residual disturbance remains as shown by loss or alteration of function in either nerve.

HYPERÆMIA OF THE LABYRINTH

is an affection of the auditory nerve secondary to a general disturbance of the system, which does not occur as a primary lesion. Therefore, what may be termed a general state of plethora or a full gouty habit is usually the cause of the series of disturbances which, occurring together, are termed "hyperæmia of the labyrinth"; and for the general treatment of such conditions the reader is referred to the sub-sections of general medicine dealing with the matters referred to. The residual deafness will then require treatment according to the class of auditory disturbance to which it belongs.

HYPERÆSTHESIA.

A phenomenon rarely to be found in individuals of the male sex, and invariably associated with some form of disturbance of the nervous system in patients of a neurotic temperament. It is consequently more within the province of the general physician that these cases should come; the general indications for treatment consist in the administration of such drugs as are usually employed in neuræsthenia. The more especially valuable drugs are strychnine, the bromides and valerian, whilst true physiological rest, which is extremely difficult to obtain, general massage, and the high-frequency current are also employed with good effect. Physiological rest may be gained by sending the patient to some extremely quiet district where the prevailing sounds are those of a low pitch; as, for instance, remote seaside villages, large pine woods, or high altitudes. When it is difficult or impossible to send patients to some such resort, it is advisable that the patient should be constantly wearing in the ears some form of sound-deadening apparatus. Small indiarubber plugs can be obtained from the instrument makers, or Hawksley's "shooter's wax" may be tried, and, failing this, cotton-wool mixed with a little simple ointment tightly packed into the ear.

HYSTERICAL DEAFNESS.

It is perhaps advisable to mention that under the term "hysterical deafness" we only include cases of monaural or binaural deafness apparently complete, occurring in a hysterical subject, and not the milder forms of auditory disturbance due to neuræsthenia. There is one very important point to be observed in the treatment of cases of hysterical deafness. It is to remember that under no consideration whatsoever should any local treatment be employed which is directed to the ear itself, *i.e.*, no inflation by air should be permitted until the patient's general nervous organisation has been rendered more stable, for as long as the neurotic tendency is in the ascendant, any treatment directed towards the ear itself will tend to fix more firmly in the mind of the sufferer that that part is diseased, and, consequently, the difficulty of obtaining a cure will be increased. Nevertheless, when this want of nerve control is to a large extent relieved or suppressed, it is certain that there will be found some slight disturbance in the organ of hearing which has caused the general neurotic condition to select the ear as a part of least resistance, and so to cause a state of hysterical deafness.

CHRONIC CONCUSSION OF THE LABYRINTH.

There are various conditions under which chronic concussion of the labyrinth may be caused. Foremost amongst these is the so-called "boiler makers' deafness," in which the patients live the large part of their lives in a great and constant noise. Shooting, under modern conditions, produces a very similar condition, although this is usually found to affect, at any rate at first, and more severely, the left ear, which, on account of the position of the head on firing, receives the bulk of the concussion. In very advanced cases, *i.e.*, where a labyrinth has already been so injured that a definite pathological lesion has been produced, treatment is very unsatisfactory, but in early cases it may be of use. It is of primary importance that the patient should be removed to a less noisy employment; in the case of a shooter he should at least protect his ears during the time of firing. The shooter's wax already alluded to, or "sound deadeners," should be used during the whole of the time the patient is subjected to the aural shocks. As a prophylactic measure this should be employed regularly by all who are subjected to the noises which we are considering. Beyond this, when the patient first complains of symptoms which on examination prove that the ear is commencing to be affected, the greatest physiological rest should be ordered, *i.e.*, that the patient should be removed as far as possible from loud noises, even from the necessity for carrying on much conversation. This physical rest should be assisted by the administration of strychnine and valerian. The valerianate of zinc is a convenient preparation, and should be administered in full doses, in pill form, to which strychnine is added to about $\frac{1}{20}$ gr. Sometimes antypirin will afford more rapid relief from the tinnitus.

CONCUSSION OF THE LABYRINTH.

This may be the effect of a fall on the vertex of the skull in which deafness supervenes without fracture of the base. It is difficult to be quite certain whether the effect is due to a central or peripheral injury. Another cause is a loud explosion, usually unexpected, as the firing of a large gun. Treatment is extremely unsatisfactory, but in the former case, where there is a possibility that the injury is located in the cerebrum, liquor hydrargi perchloridi in drachm doses [U.S.P. hydrargyri chloridum corrosivum, gr. $\frac{1}{16}$] for several months will afford the best prospect of success, but when it is due to concussion from a loud explosion no treatment is of much avail, but one should as far as possible exclude the ear from all sound for a short time. The application of blisters, frequently repeated, behind the ear may be tried.

INJURIES TO THE LABYRINTH.

When a fracture of the base of the skull extends through any portion of the labyrinth no special treatment should be adopted during the time the patient is under general treatment. Later, the treatment to be adopted must be confined to attempts at relieving the tinnitus, which is usually very distressing. Deafness in these cases is both complete and permanent. If no effect is obtained by the administration of those drugs which are recommended for the treatment of tinnitus, then it becomes a question which should be placed carefully before the patient as to the advisability of destroying the cochlea, the details of which will be found in a subsequent page. Injury to the labyrinth, *viâ* the external meatus, necessitates on the part of the surgeon only such antiseptic treatment as is necessary to promote healing and prevent suppuration. Should the latter unfortunately occur and a suppurative labyrinthitis ensue, the same treatment must be adopted as would be employed in an ordinary suppurative labyrinthitis (*see* pp. 961 and 964).

MENIÈRE'S DISEASE.

This, correctly speaking, is due to a hæmorrhage into the labyrinth in a leukæmic or allied condition. No aural treatment whatsoever can be employed with the slightest prospect of success. Such general treatment as is usual is conducted on the lines adapted to the constitutional disorder, and the aural lesion recognised as a leukæmic infarct entailing absolute deafness in the event of the patient's recovery. It is, however, customary to consider under this term other conditions producing symptoms of giddiness, noises in the head and deafness, accompanied occasionally by a feeling of sickness or actual vomiting. Cases of middle-ear origin should be treated by the administration of strychnine, hydrobromic acid, bromides or valerian, and a judicious amount of auditory inflation. Any nasal or Eustachian irregularities should also be remedied as far as possible. It is, however, to the following remedies that we have to look for the best results, apart from operative measures. Strychnine ($\frac{1}{20}$ to $\frac{1}{12}$ gr.) should be administered with full doses of hydrobromic acid, to be followed by valerian if four to six weeks' employment of the former has not been productive of marked improvement. Occasional small doses of quinine (1 to 2 gr.), administered with hydrobromic acid, will afford relief where the other drugs have failed.

Another form of Menière's disease is found in patients at the age at which arterio-sclerosis may be expected; here the auditory condition is due to very early affection of the internal auditory artery and the symptoms to a diminished blood supply to the part. It may be found long previous to any lesion in the larger vessels.

and its cause will be detected by careful investigation of the blood pressure. The auditory lesion must not be considered as a separate entity. The general arterial system must be treated and, as far as possible, caused to return to its normal state. The most valuable drugs are iodide of potassium and hydrobromic acid; operation is frequently required in this class of case.

Stomachic disturbances occasionally produce a condition of apoplecticiform pseudo-Menière disease, the chief characteristic of which is the complete restoration of the hearing after the subsidence of the attack. As this is not of aural origin, treatment will not be considered here. There remains yet another condition closely allied to Menière's disease, which has been described by Sir William Gowers under the title of aural epilepsy. It is accompanied by a peculiar series of ocular disturbances, which phenomena may be reproduced by gently irrigating the ear with cold water, between 60 and 70 degrees Fahrenheit. In these cases small doses of quinine and hydrobromic acid will occasionally afford relief. Where, however, these remedies are useless, ablation of the labyrinth is directly indicated. Although the operation would yield a definite and permanent cure, yet it should not be forgotten that deafness on that side would necessarily be complete and permanent (for details of operation, *see* Suppuration of the Labyrinth, p. 962).

TINNITUS.

While tinnitus itself is only a symptom, it is one which it is often necessary to treat as a disease, being the trouble most obvious and most distressing to the patient. When the condition is of recent origin and can be traced to transient middle-ear catarrh, it will frequently be found to be due to an obstruction of the Eustachian tube. Simple inflation by means of a catheter and Politzer's bag will at times be sufficient to control it entirely. At others it will be necessary to pass a Eustachian bougie once or oftener, according to the necessities of the case. In cases of long standing, however, there are certain guides which will assist in pointing out, to a certain extent, the line of treatment to be adopted and the prospects there are of success. The most intractable cases are those in which the tinnitus is constant and in which there is no remission or diminution of the noises. And, on the contrary, those cases are more favourable which show intermissions more or less marked. Again, those cases are favourable where the tinnitus is of a pulsatory character, and it is of all most unfavourable when subjective voices are complained of. Whether the tinnitus is of a permanent character or with intermissions, the same line of treatment is to be adopted and should consist in demonstrating the absolute permeability of the Eustachian tube. The nose should be carefully examined for any spurs or hyperæmic conditions of the turbinate. These, if found, should be treated according to the necessities of the case. The urine should always be examined for albumin and sugar, as cases of intractable tinnitus sometimes are found to be associated with the presence of these substances in the urine. A nasal lavage is always to be employed as a routine measure, and certainly often assists materially the other treatment which is employed. Of drugs, both for recent and chronic cases, one has an immense list to select from, but there are not a very large number of any great value. The most valuable is dilute hydrobromic acid, administered in doses of from 30 to 60 min. three times a day, alone or combined with the next most important drug, which is strychnine. This mixture must be administered in full doses and must be persisted with for at least six weeks, or the strychnine may be administered separately. All the valerian compounds are useful, and they also must be used in full doses to produce any marked effect. The ammoniated tincture, although unfortunately the most nauseous, is perhaps the best, but valerianic acid or valerianate of zinc are both extremely valuable. Occasionally, quinine in small doses is as useful here as in the treatment of vertigo, but it is better administered in conjunction with the bromides or hydrobromic acid. The bromides themselves may be employed, and a dose of 30 gr. of the mixed bromides of ammonium, potassium and sodium, should be given the last thing at night. In cases of pulsatory tinnitus, hydrobromic acid and digitalis, or hydrobromic acid with strophanthus or belladonna, will prove most serviceable remedies. When the patient complains of hearing voices an incipient mental derangement should be immediately suspected and the patient treated accordingly. Oto-massage may be employed in any cases of tinnitus (except the last-mentioned variety), as long as it is borne in mind that great care is always to be exercised if Rinné's test gives a positive result, and if the handle of the malleus is freely mobile, unless there is at the same time marked deafness, *i.e.*, where it is impossible further to injure the eighth nerve. When oto-massage is employed for the relief of tinnitus, it is important that it should be given every day, and that the highest number of vibrations possible should be obtained. Very rarely it will cause a temporary increase in the tinnitus. This itself is no bar to the treatment, provided that the increase in the intensity of the subjective sounds is not of long uration and if it be followed by a diminution of the subjective oises. The inflation of the middle ear, to which we alluded arlier, may be rendered very efficacious by dropping into the ndiarubber bag 3 or 4 min. of acetic ether with 1 min. of hloroform. The form of treatment which has been hitherto customary method of long usage is that of blistering behind the ar. These blisters are supposed to be efficacious, and there can e no harm in employing them; though probably, if any good esult is to be obtained by counter-irritation, it could be better btained by a seton. Tinnitus which has refused to yield to these orms of treatment which we have considered may be due, if the atient is an adult, to an early arterio-sclerosis affecting the internal uditory artery. In such cases the tinnitus will be worse in the arly morning and better towards the evening; a contrary condiion being found in the tinnitus which is increased by nerve fatigue, hich will be found to be more severe towards the evening.

Certain things are to be more or less prohibited. Amongst hese are alcohol and coffee. Excessive tobacco smoking, especially n the form of cigarettes, seems also to be rather deleterious. Besides those previously mentioned nerve conditions which may be ndicated as the cause of tinnitus, the middle ear should be carefully nspected with a view of noting whether there are any adhesions or ther abnormal conditions visible which may be relieved. The emoval of the malleus has occasionally been followed by complete elief of an otherwise incurable tinnitus. There are, besides this, wo forms of operative interference which it is necessary to consider. One is the destruction of the cochlea and the other the division of he auditory nerve. The division of the auditory nerve has been erformed several times. It is highly uncertain in its effects and as a tremendously high mortality.

OPERATION FOR THE REMOVAL OF THE COCHLEA.

The radical mastoid operation is performed and the posterior ony wall of the external meatus more freely removed than usual, nd the innermost portion of the inferior wall carefully cut away so s to expose as far as possible the whole promontory. When this as been completed a small gouge is applied to that portion of the romontory which lies between the two fenestræ and smartly hit ith the mallet. Three more cuts are made, two horizontal, one bove and one below, to meet this incision, and a vertical one as ar anterior as possible, so that the piece of bone included is roughly ircular in form. The included portion of bone is easily removed and he interior of the lower turn of the cochlea exposed to view. This must be thoroughly cleared out and the entrance to the second coil found; the outer wall of this also must be broken, either with a very fine chisel or a curette. One may then be able to recognise the modiolus, which should then be cut off with a smart tap of the chisel. A rapid flow of cerebro-spinal fluid will follow, so the opening must be plugged with a small pellet of sterilised wax. The wound is then treated with careful antiseptic precautions, and a similar line adopted to that recommended in previously described aural operations.

OPERATION IN CASES OF AURAL VERTIGO.

It is essential that a careful examination shall have conclusively demonstrated the vertigo to be essentially aural in character. Giddiness sufficiently marked to justify operation of necessity varies according to the occupation and relative means of the patient. Thus, in those who are dependent entirely upon their own exertions for their livelihood, a much less prolonged course of treatment, aiming at relief by means of drugs, is more justifiable than in those who are not dependent in the same way, and especially in those cases where the condition is obviously due to arterio-sclerotic changes in the labyrinth; for those arterio-sclerotic changes, if uninfluenced by drugs, will usually have a duration of not more than two or five years, at the end of which time the vertigo may cease; so the indications for operation cannot be laid down as a definite and fixed rule, but must vary entirely with the conditions to which we have alluded.

The preliminary stages of the operation, such as the preparation of the patient and rendering the part as aseptic as possible, are quite simple, and offer no particular points that require description, and the amount of the scalp adjacent to the ear which is shaved will vary with the sex of the patient and the views of the operator. The preliminary incision should be commenced at the junction of the upper and outer meatal wall, close to the tympanic membrane; it should divide all the tissues down to the bone, and should be prolonged so as to come out between the anti-tragus and the commencement of the helix, closely following the edge of the cartilage until the top of the auricle is reached. The knife is then brought back with a bold sweep to the posterior part of the mastoid process, going completely down to the bone. The dissection is then carried out from above, keeping the edge of the knife close to the anterior part of the cartilage in front and turning the flap down until the edge of the bony meatus is reached. The meatal wall is separated from the bone in its upper and posterior parts and, holding the top of the ear, the external cartilage is unrolled and the ear detached, so that it is rotated on its lower and still attached portion. The top of the ear is then attached to the skin of the neck by means of a stitch and all bleeding points secured. It is better to wrap the auricle in a sterilised cloth. One proceeds now as in the ordinary radical mastoid operation, and cutting away the bone to its utmost limit in the upper posterior part, so that the long axis of the wound is from above and behind, downwards and forwards, the posterior wall of the meatus should be cut away until it is level with the floor of the meatus, or as near as possible, without displacing the facial nerve. The ossicles are removed and the cavum tympani more freely exposed by removing the bone where the posterior part of the membrane is inserted as far back as is consistent with safety. The external semicircular canal is now well in view, and it is better to define its upper surfaces as far as one is able by removing with a small gouge the cancellous bone which surrounds it. At the same time the posterior canal may be brought into view by working directly behind the facial nerve. When these two have been thoroughly exposed, which is done much more rapidly than one would expect, the upper surface of the bony external canal is removed by means of a chisel, until the membranous canal is brought into view. Its two cruræ are followed up by means of a small gouge until their entrance into the vestibule is determined, and the portion of bone between them is removed. This may be performed by means of a hand gouge. It is better, if time permits, I think, to continue the opening backwards and downwards, so as to open the posterior canal and back of the vestibule. This part of the operation field may now be left and the stapes removed either by means of a hook or, as in these cases ossification into the round window frequently occurs, it may be driven in. The outer wall of the vestibule is then removed by means of a chisel, with which the bone in the immediate vicinity of the fenestra ovale is cut away, thus enlarging this opening as much as possible. The cochlea is to be left intact, as no good effect can be obtained by opening it. The vestibule is thoroughly curetted out both from above and below. The ampullæ are carefully curetted and the vestibular cavity scraped in order to destroy every vestige of nerve fibre which is crossing it. When this is done the whole of the cavity so exposed should be wiped out with a small mop soaked in commercial formalin. The after-treatment and dressing of the wound should be done in such a way as to obtain the most rapid healing, without any attempt being made to keep the cavity as large as that at the time of the operation, iodoform emulsion and light packing being the best treatment. This should be done entirely through the meatus, the auricle being replaced and retained by carefully applied sutures. The first dressing need not be done for seven or ten days, and after that the dressing should be done as infrequently as consistent with safety.

RICHARD LAKE.

NERVE DEAFNESS OR DEAFNESS DUE TO DISTURBANCE OF THE COCHLEA DIVISION OF THE EIGHTH NERVE.

In sudden deafness, such as occurs during specific fevers or at other times as the result of injury, the greatest reliance must be placed upon the use of pilocarpin. The drug is administered hypodermically, and should be persisted with for two weeks, and if no improvement is noted there is no hope for relief from any other method. In the progressive form of nerve deafness, whether this be due to some degenerative changes in the nerve itself or to a progressive lesion secondary to chronic middle-ear trouble, the drugs which afford the greatest amount of relief will be strychnine and valerian: though at the same time it is always well to study carefully the general condition of the patient, and to bear in mind that the eighth nerve is the one which shows most readily symptoms of loss of function due to general disturbed conditions of the system. Therefore it is extremely important that any such disturbances should be corrected in order to enable the drugs administered for the specific relief of the auditory condition to have a fair chance of acting. It is also well, even in cases of apparently pure nerve deafness, gently to inflate the ears of the patient, as it is extremely rare that a middle-ear trouble is not found at the same time as an internal ear trouble. Great care, however, must be taken not to inflate at all violently, otherwise a temporary increase of deafness will be noticed.

POLYNEURITIS OF THE AUDITORY NERVE AND AFFECTIONS SIMULATING THIS CONDITION CAUSED BY GENERAL NEURÆSTHENIC OR SIMILAR STATE OF THE SYSTEM.

In cases of polyneuritis of toxic origin, whether the toxin be that occurring in specific fevers or in any other condition, the early use of pilocarpin is strongly to be advocated. This may be preceded by a few days' treatment of fairly large doses of antipyrin in those cases of neuritis which are not accompanied by a general febrile state, unless it should, in the opinion of the attending physician, be unsafe to use this drug. With regard to the administration of pilocarpin, it should be given by hypodermic injection, not exceeding $\frac{1}{3}$ gr. at the commencement, though this may in suitable cases be increased fairly rapidly even to $\frac{1}{2}$ gr.

After this treatment has been carried out for a fortnight no further improvement is likely to be derived. If improvement has, however, followed this treatment, the patient may then be put on strychnine in large doses, or of valerian, and may be kept on this treatment for a considerable time.

In cases of neuræsthenia the general line to be adopted differs in no way from that employed when the disease is not confined to an affection of one special sense.

SYPHILIS.

Hereditary syphilis of the internal ear occurs during the period of adolescence and after the time at which interstitial keratitis appears. When the lesion occurs during the period at which the patient is being treated for some other manifestation of syphilis, and mercury is being employed, this drug should immediately be discontinued, and an iodide, together with iron and arsenic, be substituted. If, however, the patient is not or has not been for some time under the influence of mercury, then it should immediately be employed, and it will be better that that method should be adopted which will bring the patient most rapidly under its influence, as, for example, the injection of one of the insoluble salts. In acquired syphilis, again, it depends entirely as to whether or not the original treatment for the primary and secondary conditions were thoroughly carried out or not. In the latter cases iodides would properly afford the best result, and should be given either as iodipin, iodoform, or some similar preparation; if, on the contrary, the original treatment was not satisfactory, biniodide of mercury should be employed, unless the practitioner prefers injections. The modern treatment by intra-venous injection of "606" must depend upon the presence or absence of active syphilis, as shown by the Wassermann reaction.

RICHARD LAKE.

DEAF-MUTISM.

THE CAUSES OF DEAFNESS IN CHILDREN.

DEAFNESS so great in degree that it prevents the development of speech, or jeopardises already acquired speech in a young child (surdism), depends almost always on disease of the sound-perceiving apparatus of the ear, whether the sound-conducting apparatus be involved or not.

Deaf-mutism, the condition resulting from such degree of deafness, exists in the proportion of $\frac{1}{1500}$ or $\frac{1}{2000}$ of the population of most European countries. Fully half the cases of deaf-mutism are congenital or occur so early in childhood that they have to be classed as such; nearly half can be clearly traced to the diseases of childhood, chief of which as causes of deafness are meningitis, scarlet fever and measles. Amongst congenital cases, the intermarriage of members of deaf fraternities and the intermarriage of cousins are certainly causes. Hereditary syphilitic disease probably causes congenital deafness.

THE PATHOLOGY OF DEAF-MUTISM.

Whilst it is certain that destructive changes in the middle ear occurring early in childhood in connection with scarlet fever and measles may cause deaf-mutism or delay in the acquisition of speech, this latter result is quite exceptional, unless when the internal ear is also involved, and it is extremely doubtful if the middle ear changes due to adenoid growths ever cause deaf-mutism.

The pathological changes which are the real cause of the condition are to be found in the internal ear.

These changes are destruction by inflammatory processes of the cochlea, or of the organ of Corti, while the labyrinth may be converted into solid bone. Absence of parts of the labyrinth and evidence of arrest of development are comparatively rare, so that even in so-called congenital cases diseased processes similar to those occurring after birth are probably the immediate causes of the deafness in deaf-mutism.

THE EFFECTS OF DEAFNESS ON THE CHILD.

Deafness in a young child does not remove the tendency or impulse to speak, but without hearing the child has no knowledge of any of the conventional forms of speech adopted by men, and he falls back on a primitive form of language, the expression of which does not depend on hearing; the language of natural signs, a language which has nothing to do with finger-spelling, which, like speech, is natural to hearing and to deaf children, but which, unlike speech, has not passed out of the onomatopœic stage of language. Hence deaf people of all countries may communicate by this simple sign language, which however is quite inadequate for the expression of any but the simplest wants and ideas. As this sign language is not practised by hearing people, a deaf child's existence is one of wonder and puzzle. All young children gain knowledge chiefly by asking questions. Deaf children have no language in which to ask them, and their minds remain undeveloped and uninformed.

A clinical classification of deaf children for educational purposes is the chief need of our time and a clinical examination will divide deaf children into these classes :

(1) The true deaf-mutes; those who have been born deaf or have become deaf before the acquisition of speech and are so deaf that speech cannot be taught through hearing.

(2) The semi-deaf, or those who have so much hearing left that some speech has been taught or may be taught through hearing.

(3) The semi-mute, or those who, usually with no hearing left, have some speech left. The semi-mute have usually had perfect hearing and have lost it before the age of five years.

Of these classes, not only the second but the first have some hearing left. As a rule the semi-mute are quite deaf.

Diagnosis and Prognosis in Deaf-mutism.—If a young child does not begin to speak during the second year he is probably deaf and will not speak at all. In testing for deafness the human voice as used in shouting and a large dinner bell are the best tests. These should be used behind the child's head so that he cannot see the tests, and someone should watch the facial expression of the child during the test.

The prognosis in true deaf-mutism is so bad that no hope can be given that hearing will ever be restored. In children who are semi-deaf or very hard of hearing the treatment of the naso-pharynx, the ventilation of the middle ear and the treatment of any middle ear suppuration which may be present, may improve hearing and make the acquisition of correct speech easier.

The Surgical Treatment of Deafness in Children.—This consists in removing enlarged tonsils and post-nasal adenoids and in treating any purulent or hypertrophic rhinitis. A free air-way must be given through the nose. Any middle ear suppuration should be treated by cleansing and drying the tympanum and by ventilation of the middle ear by means of the air bag. In this way the hearing of the semi-deaf will in many cases be improved and the acquisition of speech rendered easier. Inveterate middle ear suppuration should be treated by mastoidectomy as in hearing children.

The Educational Treatment of Deafness in Children and Adults.—That the movements producing speech are as characteristic to the eye as the sounds representing speech are to the ear is a physiological truth, the application of which is rendered difficult by the fact that many of these movements take place within the mouth and are therefore invisible. That enough are visible, aided by facial expression and natural gesture, is the principle on which the art of speech-reading is taught to the deaf. That without the aid of sound deaf children can be taught to produce recognisable spoken words is the principle on which oralism is built. The practice of oralism is difficult, the speech of the deaf is never and their lip-reading is seldom perfect, but the results attained are certainly worth getting, and place the orally-taught deaf child in contact with the wider world of hearing people.

There are two classes of deaf children, comprising together about one-fifth of the whole, who cannot be profitably taught orally, viz., the mentally defective deaf and the deaf with very bad eyesight. Hitherto oralism has partially failed for these reasons: (1) It has not been started early enough, usually not before seven years of age, and thus the years generally devoted to language formation have been lost to deaf children. (2) Because no clinical classification has been made, oralism has been applied to children who could not succeed on the oral method within the limits of an ordinary school period of eight or ten years. (3) Oralism has been carried on chiefly in institutions where, during the hours out of class, all kinds of deaf children associated, and where consequently signing and finger-spelling were used. Orally-taught deaf children should not associate with one another outside the class-room. They should attend a day school, and after school should associate with hearing people only, thus being compelled to use their speech.

When blindness accompanies deafness, the acquisition of speech becomes extremely difficult and language in most cases has to be based on the sense of touch.

JAMES KERR LOVE.

DISEASES OF THE SKIN.

ACNE VULGARIS.

General Remarks.—It has often been said of acne vulgaris that it is one of the most intractable of skin affections. This is doubtless true in a few cases; but it is the exception rather than the rule, and usually means that the case has been improperly treated in the first instance and allowed to become deeply seated and widely distributed before it was thoroughly taken in hand. For the rational treatment of this affection it is necessary that the physician should understand something of its pathogenesis. The underlying factor in acne vulgaris is the oily condition of the skin known as seborrhœa, the exact cause of which is at present uncertain, though the general trend of opinion is that it is not microbic in origin, but is in many instances an individual peculiarity, and in others is associated and possibly causally connected with certain general derangements, such as digestive disturbances and constipation. On this basis of seborrhœa, probably as the result of the action of the micro-bacillus of Sabouraud which grows actively in the oily sebaceous material, blackheads or comedones are formed in the mouths of the pilo-sebaceous follicles. Inflammation and suppuration taking place around the comedo produce the characteristic acne pustules. The inflammation is definitely microbic, and is most probably due to the action of the Staphylococcus pyogenes aureus, although certain observers have claimed that the micro-bacillus is responsible for it. In addition to the typical acne pustules indurated granulomatous nodules and cyst abscesses containing a gelatinous fluid may also result from the presence of the micro-organisms deep down in or beneath the follicles.

These etiological facts indicate the line of treatment to be adopted, which should consist in (1) the removal of the comedones, the evacuation of the pus, and the approximate sterilisation of the cutaneous surface; (2) an attempt by general measures to improve the tone of the skin, so as to render it more resistant to the specific micro-organisms and to reduce the tendency to seborrhœa; and (3) the removal of the effects of the acne, namely, the rough thickened skin and the hypertrophic scars. If this is carried out in a thorough manner there is no skin affection in which treatment is better repaid. The ultimate prognosis is almost invariably good. Many cases tend to clear up themselves in early adult life, but if they are allowed to do so without treatment, and if deep-seated pustules and abscess cysts are permitted to break themselves or are opened by a needle, scarring is almost inevitable. The treatment may be considered under the headings of local, general, and vaccine treatment. Of these by far the most important is the local treatment, but to obtain the best results it should be combined with suitable general measures.

Local Treatment.—The local treatment consists in: (1) Operative treatment to remove the comedones and to get rid of the pus; (2) the treatment of the skin by parasiticide applications; (3) the methods of removing disfigurement due to scarring; and (4) the after-treatment to prevent recurrence.

(1) *Operative Treatment.*—(*a*) Removal of the Comedones.—The first aim in the treatment of acne is the removal of the comedones. (For a description of the measures to be adopted for this purpose, *see* Treatment of Comedones.) (*b*) Evacuation of the Pus.—The next procedure is the letting out of the pus, not only from superficial pustules, but also from the indurated nodules and abscess cysts. Each pustule should be opened and the pus should be squeezed out. In the case of the deep-seated indurated lesions a bead of pus is usually present also, and its exact position may be revealed on pinching the nodule between the first finger and thumb by the part of the surface over it becoming paler in tint. Various forms of small lancets may be employed for this purpose, such as a linear cataract knife or a small tenotome. The instrument I prefer is a double-edged knife, with straight blades tapering to a fine point. A special instrument is made for the purpose known as the acne lancet, with shoulders to prevent the instrument penetrating too deeply, but this is no advantage, as the pus in some nodules is more deeply seated than the instrument can reach. The lancet is pushed vertically down into the pustule or nodule till the pus is reached, and the contents of the lesion are then squeezed out. It is very important to open the lesions with such a knife and not to allow the patients to tamper with them with a needle, or let them burst of their own accord, as in that way scarring is almost inevitable. The operation, if skilfully performed and if the knife is sharp, is practically painless and leaves no mark. After the pus has been expelled the small abscess cavities may be syringed out with 1 in 40 carbolic lotion by a hypodermic syringe, or a pointed match or glass pen with spiral ridges and grooves may be dipped into carbolic acid and inserted into it. In

this way the remaining microbes may be destroyed and the cavity prevented from refilling. The latter procedure, though useful, should only be employed on covered parts, as it is apt to leave scars.

When the pustular lesions have been thoroughly dealt with by the lancet, a boric acid fomentation or a compress of hydrogen peroxide (10 vols. per cent.) should be applied to the skin for a quarter of an hour, and after its removal a powder containing equal parts of boric acid, precipitated sulphur and starch should be dusted over it.

The above operative procedures, which may be termed the "toilet of acne," should be repeated frequently, daily if necessary, till the pustulation is checked and the comedones cease to appear.

(2) *The Treatment of the Skin by Parasiticide Applications.*—In addition to the operative treatment, parasiticides should be applied to the skin to destroy the micro-organisms responsible for the pustulation and possibly for the comedones. So long as these microbes exist on the surface of the skin mild antiseptics are capable of doing this, but when the microbes are present in the depths of the follicles even strong antiseptics may be ineffective. Of the various parasiticides which may be used for this purpose, such as carbolic acid, mercury, resorcin, sulphur and ichthyol, sulphur is the most generally useful, and readily destroys the micro-organisms. These antiseptics may be employed in the form of lotions, powders, medicated soaps and ointments.

LOTIONS.—The following formulæ for sulphur lotions are serviceable: ℞. Sulphur. Præcip., ʒj; Zinc. Sulphat., ʒj; Potassæ Sulphid., ʒj; Glycerin., ʒss; Aquam Rosæ, ad ℥iv. ℞. Sulphur. Præcip., ʒj; Glycerin., ♏5; Alcohol, ♏30; Aquam, ad ℥j.

For use, pour a little of one of the lotions into a saucer, then dab it on or press it into the skin with a piece of cotton-wool, or apply it on a piece of lint saturated with it, and let it dry on. This should be done each night, and any deposit which it may leave is washed off in the morning.

Sulphur lotions are not always borne well and may set up a dermatitis, followed by desquamation. This, provided it is not excessive, is no disadvantage, as it helps to reduce the keratosis at the mouth of the follicle, which is responsible for the blackheads; but in delicate skins, on account of the discomfort and inflammation produced by it, it may have to be stopped, and the inflammation reduced by soothing remedies, such as calamine cream or lotion.

As substitutes for sulphur various other antiseptics may be used in the lotions, such as ichthyol (20 per cent.) in water or rectified spirit; resorcin (5 per cent.) in rectified spirit; salicylic acid (2 per cent.) in rectified spirit; perchloride of mercury (5 per cent.) in rectified spirit; boric acid (5 per cent.) in rectified spirit; and camphor (5 per cent.) in rectified spirit.

Considerable experience is required in the choice of the remedy suitable for the individual case, and no hard-and-fast rules can be laid down regarding it, as different skins vary so greatly in their toleration of applications, and those affected with acne are more readily inflamed than normal skins. One general principle, however, may be laid down, namely, that in every case mild applications should be employed in the first instance till the degree of toleration of the individual skin is ascertained, and the strength then gradually increased. In the treatment of acne of the back and chest stronger remedies may be tolerated and are more necessary than on the face, such as 10 per cent. liquor calcis sulphuratæ or 40 per cent. formaldehyde. These after being applied for a few days produce dermatitis, which should be subdued by dusting powders or a bland zinc paste. In connection with the treatment of acne of the trunk, when there is marked pustulation it is necessary that the underclothes should be disinfected.

Powders.—Dusting powders are of service in reducing the greasiness of the skin and in soothing irritation, and are of special value in the treatment of acne of the back. They should be applied after the lotion has dried on the skin. Of these precipitated sulphur itself is an admirable powder, or it may be combined with zinc oxide with 2 per cent. of camphor added to allay itching. Dusting powders containing boric acid, salicylic acid and magnesium carbonate are also useful.

Soaps.—Sapo mollis, sapo viridis, and the different medicated soaps, are useful adjuncts in the treatment, especially when the back and chest are involved, in order to cleanse the skin of grease and to intensify the action of the lotions. Instead of the green soap, soap liniment may be employed, to which may be added 2 per cent. of resorcin or salicylic acid. These should be rubbed into the skin twice a day with a piece of flannel moistened in hot water. The medicated soaps which are of most service are those containing a considerable portion of sulphur, combined with camphor and balsam of Peru. To obtain the maximum effect from the soap it should be lathered on thickly with a shaving brush and allowed to dry on; as it is irritating when applied in this fashion the lather should be left on only for a few minutes at first and the time gradually increased as toleration is established. One of the chief virtues of the soap is the macerating property of its alkali, which removes the superficial layers of the epidermis and allows the parasiticide to act on the micro-organisms.

Ointments.—In the early stages of the treatment it is usually best to avoid greasy applications unless the patient complains of the skin being excessively dry and uncomfortable, when the occasional use of cold cream may be permitted. Various ointments have been recommended containing sulphur, salicylic acid, resorcin, and mercury in a basis of lanolin or vaselin. But these, though they penetrate more deeply than lotions, cannot get deep enough to reach the micro-organisms which are situated in the lower part of the follicles, and their greasiness increases the inflammation, stops evaporation, and may even cause œdema and eczematisation. These facts are taken advantage of, however, in what is known as the "peeling cure" of acne. As a substitute for ointment, plasters, such as those of the Beiersdorf series, containing mercury and carbolic acid in different proportions, may be used; these are specially indicated when much pustulation is present. They are more effective than ointments, because by them medicament is kept continuously applied so long as the plaster is left on.

(3) *The Methods of Removing Thickening, and Disfigurement due to Scarring.*—In the final stages of the disease, when little is left except thickening and irregularities of the skin and the majority of the comedones are removed, considerable improvement can be produced by peeling the skin. This treatment consists in the frequent application of an irritating ointment of the keratolytic class, which produces an inflammatory reaction followed by peeling and reduces the hyperkeratosis, which affects not only the mouths of the hair follicles but also the intervening skin. One or other of the following ointments may be employed for the purpose: ℞. β Naphthol, ʒj; Sulphur. Præcip., ʒiij; Saponis Viridis, ʒij; Ung. Aq. Rosæ, ʒij.

This is rubbed into the skin twice a day for three days, and the inflammation which it causes is then reduced by the following bland paste: Zinc Oxide, ʒij; Starch, ʒij; Lanolin, ʒij; Soft Paraffin, ʒij; Salicylic Acid, gr. 10.

When the inflammation has subsided, the irritating ointment is again applied if necessary.

Instead of β naphthol, resorcin may be substituted: ℞. Resorcin, ʒij; Zinc Oxide, ʒiij; Starch, ʒj; Benzoated Lard, ℥jss.

Should these applications prove too irritating, the percentage of β naphthol or resorcin may be reduced, or a lotion consisting of resorcin in spirit applied instead, night and morning, till the skin becomes inflamed and glossy. This form of treatment, while giving good results if properly carried out, is extremely unpleasant, and should not be undertaken without explaining to the patient the discomfort which it entails and the necessity of confinement to the house for about a fortnight.

Röntgen Rays.—For the reduction of the hypertrophic scarring in old-standing cases an application of the X-rays gives good results. In such cases a full pastille dose should be given at a regulated distance. The X-rays are also of value when the comedones are unusually hard, prominent and numerous, and the intervening skin is thickened. A full pastille dose will reduce the thickening and cause the comedones to shrivel and disappear. It is advisable to give a single full dose rather than several partial ones, as the smaller doses repeated are more apt to inflame a skin affected with acne. The X-rays should on no account be employed while the skin is inflamed by local applications, nor should any irritating lotion or ointment be applied for at least a month after the exposure. It is essential that the exposures should be given with the utmost care as regards dose and distance, in order to prevent the occurrence of a serious dermatitis on the face.

In the local management of a case of acne it is necessary to deal at the same time with the scurfy condition of the scalp with which the acne is so frequently associated, as the scurf harbours both micro-bacilli and staphylococci, which by being shed on the face perpetuate the disease. This should be treated on the lines laid down for the treatment of seborrhoic dermatitis of the scalp, namely, by the application of sulphur-salicylic ointment, washing with soap spirit lotion, or the use of the following non-greasy brilliantine: Salicylic Acid, gr. 10; Castor Oil, ♏20; Rectified Spirit, ad ℥j.

(4) *After Treatment.*—After the disease has been actively attacked and its more marked features destroyed, it is important to continue a mild form of local treatment to prevent its recurrence. The comedones should be extracted in a routine fashion, and the skin should be bathed daily with a little boiling water to which a few drops of tincture of benzoin or a teaspoonful of eau de Cologne have been added, or washed with some mild medicated soap containing sulphur, camphor, and balsam of Peru. A lotion of boric acid, 5 per cent., or resorcin, 1 per cent. in rectified spirit, may be dabbed on the skin once a day, and after drying it a powder containing equal parts of zinc oxide, starch and precipitated sulphur, or a bland zinc paste may be applied.

Internal Treatment.—Though acne is essentially a local disease, yet its course, if not its existence, is largely influenced by the general health of the patient, and general treatment is not only advisable but essential. There are no drugs which can be regarded as specifics for acne. There was a time when sulphur and its compounds were believed to have a specific action in checking the pustulation of this disease, and one of the most popular preparations was the sulphide of calcium, ¼ gr. t. d. s.; but the reputation of the drug in this connection is not what it was, and my own experience of it has been disappointing. Arsenic also has had its advocates, but the mere fact of its tendency to upset the digestion makes it liable to do more harm than good. Yeast is another remedy which has an influence in checking pustulation, and has been recommended for the treatment of acne. It may be prescribed in the form of fresh brewers' yeast, a teaspoonful three times a day in water before meals, but the smell and taste of the yeast, and its tendency to cause gastro-intestinal disturbances, such as diarrhœa and flatulence, are great drawbacks to its use. There are several preparations of yeast, however, which have not these disadvantages, of which the most important are nuclein and ceridine, and these are worthy of a trial (*see* Treatment of Boils).

Apart from these partially specific remedies, the internal treatment must be carried out on general principles, and any defect in health sought for and as far as possible corrected. The most frequent predisposing cause is indigestion, with constipation and derangement of the liver. The indigestion causes the face to flush after meals, and so intensifies the sebaceous flux, and at the same time favours the introduction into the blood of harmful substances. Weak digestions should be treated by acid tonics, bismuth, pepsin, and other recognised remedies. Fermentation in the lower part of the alimentary tract may be counteracted by salol, salicylate of bismuth, naphthol, or by a course of sour milk, and constipation should be dealt with on general principles. With regard to diet, no detailed rules are necessary. It should be light and easily digestible, and articles which tend to produce urticaria, such as cheese, shellfish, pickles, sweet wines, beer and coffee, should be scrupulously avoided. When the digestive organs are acting properly, almost any food can be digested, but if they are weak many articles of diet should be eschewed, such as cream, oatmeal, pastry, nuts and excess of meat. In girls the commencement of the menstrual period is frequently associated with inflammation of existing comedones and crops of pustular lesions, on account of the toxic state of the blood coincident with it. It is consequently advisable to prescribe a saline aperient, with or without the addition of a small quantity of iron, to be taken a day or two before the period is expected, sufficient to cause two evacuations daily. Fresh lesions are apt to appear also in connection with dysmenorrhœa, and the correction of the latter disturbance by suitable means is of great value in combating the disease. Scrofulous individuals are apt to have acne as their skins are thick and oily, and they have a profuse growth of hair, large lymph-glands, and anæmia. The anæmia is a potent factor in aggravating the disease, as it diminishes the resistance of the skin and prevents it reacting in a healthy manner to micro-organisms. These cases must be treated on general medical principles. In certain cases, as no definite derangement of the general health can be detected, though the patients themselves appear to be below par, a tonic *régime* is indicated with iron, hypophosphites and nux vomica, massage, sea-bathing, cold douching, and other such general measures.

Vaccine Treatment.—The vaccine treatment of acne vulgaris is at present on trial, and the results are too varied to permit of any definite statement being made as to its value. The vaccines are prepared from the micro-bacillus and the staphylococcus pyogenes aureus, and are obtained either from the patient's own micro-organisms or from stock cultures. According to the type of case the precise vaccine is chosen; when comedones predominate a vaccine of micro-bacilli is injected, when indurated and pustular lesions are present a mixed vaccine is employed, and when pustulation is the most marked feature a staphylococcus vaccine is used. The dose suggested is about 5 millions of the micro-bacillus and 125 millions of the staphylococcus, the injections being given about once a week. According to Fleming, it is unnecessary to employ an autogenous vaccine except in resistant cases, and it is not essential to control the inoculations by the opsonic index, as the negative phase which follows too large a dose of vaccine, or which takes place after the effect of the vaccine has worn off, is indicated by a fresh outbreak of lesions. The dosage should be so regulated as to show no negative phase. In a certain number of cases this treatment if properly carried out produces an amelioration of the pustules so long as the resistance of the individual is kept up, but should a negative phase assert itself, or the resistance be lowered by discontinuing the treatment, the pustulation may recur more intensely than before the treatment was begun. The treatment by itself does not appear to stop the formation of comedones, and it has yet to be proved definitely that the comedo is due to the micro-bacillus. If the vaccine treatment can only reduce pustulation which can be better and much more quickly accomplished by proper surgical procedures, with the removal of the comedones at the same time, there seems to be little point in employing it. By itself it is of doubtful value, and when bined with thorough local treatment it is probably of less e than local treatment combined with a well-considered constitu treatment on general medical lines (*see* Vaccine Therapy, p. 2

J. M. H. MACLE

ADENOMA SEBACEUM.

There is no drug taken internally which has any effect on this disease, although bromides are frequently given for the associated cerebral condition. The best method of eradicating the disease is by scarification in a criss-cross manner, either with a fine electro-cautery or a scalpel. As a rule, it is necessary to repeat the operation several times as the lesions tend to recur. The skin should be prepared in the usual way, and it is advisable to give a general anæsthetic on account of the deficient mental condition of the patient. Ung. hydrarg. ammon. (half the B.P. strength) should be applied after the operation, and continued daily till the lesions heal.

Electrolysis sometimes gives equally good results. When the lesions are small a single needle, when large a multiple needle, is attached to the negative pole of the battery; a pad attached to the positive pole is placed on the neck or some other convenient part, and a constant current of 2 to 3 milliampères is passed through each needle until there is free bubbling, generally for about one minute. This treatment also will require occasional repetition to produce a complete cure, and it is advisable to give a general anæsthetic. A calamine lotion should be applied after the operation.

Chemical caustics are painful and unsatisfactory. When there is much telangiectasis, radium will sometimes give a fair result.

WILFRID S. FOX.

ALOPECIA.

The treatment of alopecia or baldness varies according to the causation and type of case, and will be considered under the following headings: (1) Alopecia areata; (2) Alopecia cicatrisata; (3) Alopecia congenitalis; (4) Alopecia hereditaria præmatura; (5) Alopecia senilis; (6) Alopecia neurotica; (7) Alopecia symptomatic of general diseases; (8) Alopecia resulting from morbid conditions of the scalp; (9) Alopecia seborrhœca.

ALOPECIA AREATA.

General Remarks.—As alopecia areata is a disease of which the exact cause is unknown, the treatment is consequently somewhat empirical, and as the course of the affection is usually prolonged and the prognosis uncertain, considerable tact is required on the part of the physician in the management of the patient. The theory that it is of parasitic origin is not established, nor is there any conclusive evidence that it is contagious. There is, therefore, no necessity to isolate patients suffering from it, nor to restrict them in any way from contact with their fellows. It is important, however, in this connection that the physician should be certain regarding the diagnosis, as certain cases of ringworm closely simulate alopecia areata, and should there be any doubt a microscopical examination must be made. The type of ringworm with which it is most likely to be confused is the so-called "bald ringworm," due to the "megalosporon endothrix" fungus. Whether alopecia areata is of toxic or trophoneurotic origin, it would seem in the majority of cases that the cause, whatever it may be, gradually ceases to operate spontaneously, and that re-growth, as a rule, takes place; but whether this will happen after six months or be delayed for a year is uncertain. The re-growth is hastened by judicious treatment, but it may also occur in spite of some form of treatment which may be not only unsuitable but harmful. It is well to explain this fact to the patient, as it not infrequently happens that patients, becoming tired of the slow progress which they seem to be making under a certain *régime*, seek relief from patent remedies or fall into the hands of some quack or so-called "hair-specialist," and should the spontaneous recovery and re-growth take place about the time when the new remedy is being tried it is unnecessary to add that it will probably get the credit for the improvement. It is well to warn the patient also of the fact that recurrences of alopecia areata are frequent, and that there is a tendency for subsequent attacks to be more extensive than their predecessors. When the patches occur about the margin of the scalp, especially about the nape of the neck, re-growth does not take place so quickly as when the patches are central. In generalised cases, where the whole of the pilary system is affected, if the hair has not begun to re-grow in a year the prognosis is unfavourable; cases, however, have been recorded in which re-growth has taken place after several years. As a rule the new hair is lighter in colour, and may even be white. The whiteness may remain permanently, but usually in the course of a few months the hairs darken and assume the tint of the old hairs, or fall out and are later replaced by pigmented hairs.

The treatment of alopecia areata is principally local, but to obtain the best results the local treatment should be combined with suitable general measures.

General Treatment.—Any defect of the health, which may be even remotely connected with the alopecia areata, such as anæmia, indigestion, intestinal troubles, cardiac and circulatory affections, diseases of the kidneys, and rheumatism, should be attended to on general medical principles. It not infrequently happens that patients suffering from this disease are mentally depressed, overworked, complain of headaches and are neurasthenic, and the fact of their hair falling out still further adds to their unhappiness. In such cases a tonic treatment, with the usual remedies such as nux vomica, phosphates, iron, arsenic, rest, general massage, change of air and surroundings, sea-bathing, and exercise, is indicated. In the case of debilitated children of the hospital class more benefit can be obtained from better food and improved hygienic conditions than from any form of local application. In view of the possibility of alopecia areata being reflexly produced in some instances by local irritation, any source of such should be carefully sought for and suitably dealt with. The hygiene of the mouth should be attended to and defective teeth removed or stopped, errors of refraction should be corrected, catarrh of the auditory canal or aural disease suitably treated, and adenoids removed.

There are no drugs which taken internally have any definite claim to be regarded as specifics for causing the re-growth of the hair. Arsenic has been employed in this connection, but it probably acts as a general nerve tonic rather than as a specific remedy. Pilocarpine has had a considerable reputation for this purpose, and cases have been recorded in which re-growth has taken place soon after it has been employed. It may be given by the mouth in the form of $\frac{1}{8}$ to $\frac{1}{4}$ gr. of the nitrate, or $\frac{1}{30}$ gr. of the hydrochloride may be injected locally into the scalp. The action of this drug on the hair growth is uncertain, although it occasionally gives good results, but the discomfort from the excessive perspiration which it causes and the danger of inhibiting the heart's action by it necessitate its being used with the utmost caution.

Local Treatment.—Of first importance in the local treatment of alopecia areata is *the proper hygiene of the scalp.* The scalp should be washed about once a month in women with any non-irritating toilet soap or egg-julep, and about once a fortnight in men. If there is any dandruff present, soap-spirit lotion containing two parts of green soap, one part of spirit and a few drops of thymol should be employed and rubbed on the scalp with a piece of moist flannel. Any associated diseased condition of the scalp such as pityriasis, impetigo, or pediculosis must be treated by appropriate remedies. Epilation of the hairs around the bald patches has been advocated with the object of arresting the progress of the disease, but I have seen no benefit from this procedure. If the beard or moustache is affected they should be shaved regularly, as it not only reduces the disfigurement but stimulates the hair growth. In generalised cases it is necessary to wear a wig, but when the disease is not too extensive this should be avoided, as the pressure of the wig is apt to impede the circulation and retard the re-growth. Should a wig be advisable it is important to have it carefully fitted, to avoid constricting any part of the scalp unnecessarily.

The local applications may be divided into two groups, namely, *antiseptics* and irritants or stimulants. Those who believe in the parasitic origin of the disease advise the application of lotions or ointments containing mercury, carbolic acid, sulphur, resorcin, and salicyclic acid; such, for example, as the following: ℞. Hydrarg. Perchlor., gr. 2; Spirit. Vini Rect., ad ℥j. [U.S.P., ℞. Hydrargyri Chloridi Corrosivi, gr. 2; Alcohol, ad ℥j.] ℞. Resorcin, ʒj; Spirit. Vini Rect., ad ℥j. ℞. Sulphur. Precip., gr. 20; Ac. Salicyl., gr. 10; Paraffinum Molle Album, ad ℥j. ℞. Hydrarg. Perchlor., gr. 2; Ac. Carbol. Liq., ♏10; Paraffinum Molle Album, ad ℥j. [U.S.P. ℞. Hydrargyri Chloridi Corrosivi, gr. 2; Phenolis Liquefacti, ♏10; Petrolatum Album, ad ℥j.]

These should be applied all over the scalp daily, and especially rubbed into the bald patches. They are chiefly valuable when dandruff is present, as this is due to certain slightly virulent micro-organisms in the scalp. A useful antiseptic lotion for general use

in most cases contains: ℞. Resorcin., gr. 10; Hyd. Perchlor., gr. 2; Glycerini, ♏10; Spirit. Vini Rect., ʒij; Aq. Rosæ, ad ℥j. [U.S.P., ℞. Resorcini, gr. 10; Hydrargyri Chloridi Corrosivi, gr. 2; Glycerini, ♏10; Alcoholis, ʒij; Aquam Rosæ, ad ℥j.]

The glycerine should be omitted in the case of women, as it is apt to make their long hair unpleasantly sticky, and the resorcin should be omitted when the hair is fair, as it stains it a rusty tint after exposure to the air.

More valuable as local remedies, however, are the *irritant and stimulant applications*, of which the most commonly employed are acetic acid, turpentine, cantharides, chrysarobin, and capsicum. At one time the customary treatment was blistering by such applications as: ℞. Acet. Cantharid., ʒij; Lin. Terebinth. Acet., ℥j [U.S.P., ℞. Cantharidis, 2 parts; Acid. Acetic. Glacial. et Aquæ Destillatæ, partes æquales, 20 parts]; ℞. Tinct. Cantharid., ʒj. Spirit. Vini Rect., ℥j; ℞. Chrysarobin, ʒss; Spirit. Vini Rect., ℥j. [U.S.P., ℞. Olei Terebinthinæ Rectificati, ʒiv; Acid. Acetic. Glacial., ʒj; Lin. Camphoræ, ʒiv.; Tinct. Cantharidis, ♏viij.]

One or the other of these may be painted on the bald areas twice a day until blistering takes place.

This procedure gives excellent results, but it is unpleasant, and milder stimulants, being equally effective in the end, are preferred by the patient. Of these milder applications the following formulæ are useful: ℞. Acet. Cantharidis, ʒss; Ol. Citron, ʒij; Spirit. Vini. Rect., ℥j. ℞. Ac. Acet., ʒss; Chloroform, ad ℥j. ℞. Tinct. Capsici, ♏5; Eau de Cologne, ʒij; Spirit. Vini. Rect., ad ℥j. ℞. Lin. Camphorœ, ʒiv; Lin. Ammoniæ, ʒiv; Lin. Chloroformi, ʒiv. These should be applied every day to the bald patches, being either painted on or applied with a piece of cotton wool soaked in them.

Chrysarobin is another useful stimulant, and may be applied in the form of a 5 per cent. ointment. It has to be used with great care, however, on the scalp to avoid transferring it to the eye and so setting up a conjunctivitis. It has the additional disadvantage of staining the scalp and the hair. The best method of using it is in the form of a pencil made with wax and lanolin as follows: Chrysarobin, ʒj; Wax, ʒij; Lanolin, ad ℥j, or by dissolving it in traumaticin (guttapercha ʒj, chloroform ℥j), which dries on the skin in the form of a thin film. The choice of the irritant and the strength employed depend on the degree of resistance of the scalp under treatment. It is always well to begin with mild applications, and gradually to increase their strength until the limit of toleration is reached.

Physical Remedies.—Various physical remedies have also been employed in the treatment of this disease with more or less benefit, such as massage, actinic rays of light, X-rays, and high frequency currents.

Massage of the scalp is of undoubted value, and when practicable should always be advised, as it improves the local circulation, and prevents the scalp from becoming too tightly adherent to the skull. It is specially valuable when the scalp is stretched over the skull, and the adipose layer is deficient. It should be carried out by an attendant, but if such be not available, it can be done by the patients themselves. The procedure is simple, and is as follows: the fingers should first be dipped in almond oil; the thumbs are then placed at the sides of the head, and the scalp is moved in all directions over the skull by the pressure of the fingers. In this way the whole scalp should be gone over systematically, fifteen or twenty minutes being devoted to the proceeding once or twice a day.

Instead of massage, friction with a towel or brushing with an ordinary hard brush, or with a metal brush forming an electrode in a galvanic or faradic circuit, have been recommended, but none of those are as good as massage, and the brushing is apt to be harmful by superficially lacerating the scalp.

The fact that the hair grows with greater activity in summer than winter, when the actinic rays of light are in largest quantity, suggested the advisability of employing light as a means of treatment for this disease. The rays for this purpose may be obtained from a *Finsen lamp* or a *mercury vapour lamp*, and considerable benefit may be derived from their action. The rays by producing a mild inflammatory action are definitely stimulating, and are probably more penetrating in their effect than the different local applications already referred to. Exposures of an hour at a distance of six inches from a Finsen-Reyn lamp, or a Uviol mercury vapour lamp should be given, and repeated as soon as the inflammatory reaction has subsided, which it usually does in a few days.

Various other electrical methods have been employed, such as brush discharges from a high-frequency apparatus and sparks from a static machine. The latter to be effective are painful, and being no more certain in their action than either the actinic rays or massage are not to be recommended.

In extensive cases of alopecia where the eyebrows and eyelashes have gone, the discomfort entailed by the absence of the eyelashes, which not only shade the eye but protect it from the entrance of foreign bodies, may to some extent be obviated by wearing false eyelashes on the upper lids. These are made as strips or ribbons of hair of different tints, and are fixed to the upper eye-lid by spirit gum. They are fairly comfortable to wear, and are realistic in appearance, their only disadvantage being their costliness.

ALOPECIA CICATRISATA.

This is a rare form of alopecia with destruction of the hair follicles, characterised by the presence on the scalp of numerous atrophic bald patches, which tend to coalesce to form irregular cicatricial areas, broken up by the projection into them of unaffected parts of the scalp. The disease is slowly progressive, but in some cases a spontaneous arrest takes place. As the atrophic process involves the hair-follicles it is doubtful if much benefit can be derived from treatment, and once a part of the scalp is affected permanent baldness of that area is inevitable. On the other hand, active treatment may stop or retard the spread of the disease.

As the pathogenesis is unknown, the treatment is more empirical than rational. Any defect in the general health should be carefully sought for and an attempt made to correct it by suitable means. The local treatment generally adopted is based on the assumption that it is a microbic affection, and consists of epilation of the affected hairs and the thorough application daily of parasiticide lotions or ointments containing mercury, sulphur, resorcin, or ichthyol. Mercury is the favourite application, and may be employed as a lotion of 1 in 1000 corrosive sublimate, or as an ointment containing 2 gr. of biniodide of mercury in an ounce of vaselin.

ALOPECIA CONGENITALIS.

Congenital alopecia or absence of hair, partial or complete, is fortunately an extremely rare condition as the prognosis is absolutely bad, and no form of treatment is of any avail. In a certain number of cases, however, in which infants are born hairless the alopecia is due to delayed development, and the growth may eventually take place. But after the lapse of a year or eighteen months, if no signs of growing hairs are present, the outlook is unfavourable. In cases of delayed development, provided the scalp appears to be healthy, no treatment is required, but should any inflammation or scaliness be present it should be treated by a mild antiseptic ointment, such as: Precipitated Sulphur, gr. 15; Salicylic Acid, gr. 10; Soft White Paraffin, ℥j; and the scalp should be washed occasionally with soap-spirit lotion.

ALOPECIA HEREDITARIA PRÆMATURA.

Apart from seborrhœa and pityriasis of the scalp which are the usual causes of premature baldness, an early defluvium of the hair beginning about the age of twenty may occur as a family trait. It is more common in males than females, and may be handed down from father to son for several generations. In cases of this type the prognosis is unfavourable. An endeavour should be made to arrest or delay the process, however, by correcting any obvious defects in health, and by prescribing a stimulating local treatment, with massage of the scalp and the application of irritating lotions containing acetic acid, cantharides or turpentine, such as those recommended for alopecia areata. The slightest evidence of dandruff should be attacked by washing the scalp with soap-spirit lotion, and applying an ointment containing sulphur, salicylic acid, or mercury (*see* Alopecia Seborrhœica).

ALOPECIA SENILIS.

In old age the hair follicles and hair papillæ, like the other tissues of the body, tend to atrophy and baldness tends to result. The defluvium is very gradual, and is generally associated with whitening of the hair. The age at which it sets in varies and is dependent on the virility of the tissues. Treatment, except on general medical principles, is of no avail. It is advisable, however, to prescribe some local application, which, although it may have little or no effect in arresting the process, is pleasant to use and satisfies the patient. Such, for example, is the following lotion: ℞. Ammonii Chloridi, gr. 15 ; Resorcin., ʒj ; Glycerin., ʒj ; Spirit. Vini Rect., ℥ij ; Aq. Rosæ, ad ℥viij.

When the hair is definitely white, the resorcin should be omitted, as it is apt to turn it a rusty colour, and salicylic acid should be substituted.

ALOPECIA NEUROTICA.

More or less baldness may occur as the result of some severe nerve shock, anxiety, loss of money or position. The exact mechanism by which the fall of the hair is brought about is not fully understood, but it has been explained as the result of a tropho-neurotic influence. In a certain number of the cases the vitality of the papillæ is so impaired that the condition remains permanent, but in the majority of them, after a time varying from a few months to several years, re-growth takes place. In these cases the hair is frequently white when it re-grows, but the whiteness is usually temporary and the normal colour is gradually restored. No special form of treatment is necessary except mild stimulation by massage, and the application of a lotion containing acetic acid or turpentine in spirit. It is inadvisable to attempt to minimise the disfigurement from the whitening of the hair by means of hair-dyes for fear of injuring the hair by so doing.

Patches of alopecia may also occur from injury to a nerve and affect the area supplied by the nerve, the baldness being not infrequently preceded by severe neuralgia. The prognosis in those cases is on the whole good, and even should the nerve be destroyed a collateral nerve-supply is usually established and the hair eventually grows. Stimulating treatment should be adopted, such as menthol, 10 gr. in an ounce of olive oil or soft white paraffin; this when rubbed into the scalp is followed by a slight inflammatory reaction. The following lotion may also be applied: Tincture of Capsicum, ♏j; Eau de Cologne, ʒij; and Spirit, ad ℥j. For localised patches brush discharges from a high-frequency apparatus and faradisation are of value. As in the generalised cases, when the hair grows in again, it occasionally is white and becomes pigmented later.

ALOPECIA SYMPTOMATIC OF GENERAL DISEASES.

Alopecia may occur in association with any severe constitutional disease, but it is most common in connection with the acute exanthemata and syphilis. It is due to the temporary interference with the function of the hair papillæ by malnutrition and the circulation of toxins in the blood. It is as a rule of a temporary character, re-growth taking place with the restoration of health. In most cases it is a general thinning of the hair which occurs rather than actual baldness. The prognosis is almost always satisfactory. The treatment consists in attending to the general health by suitable means, medicinal, dietetic and hygienic, so as to restore the vital tone and eliminate the toxic factor responsible for the defluvium. The local treatment of the scalp should be stimulating in character, and consists of massage, friction, and the application of lotions containing spirit, turpentine, acetic acid or cantharides (*see* Alopecia Areata). When much of the hair has fallen out, it is usually advisable to cut the remainder short so that the local treatment may be more effectively carried out. In such cases the stimulating action of the actinic rays from a Finsen lamp or a Uviol mercury vapour lamp is of value. The syphilitic cases respond readily to anti-syphilitic remedies, but where ulceration and cicatrisation have taken place the hair-follicles are destroyed by it and the baldness remains permanent.

ALOPECIA DEPENDENT ON MORBID CONDITIONS OF THE SCALP AND HAIR-FOLLICLES.

Any form of acute dermatitis may interfere with the hair growth, and may be the cause of baldness, such, for example, as exfoliative dermatitis, acute eczema, severe psoriasis, and erysipelas. In these cases the baldness is generally incomplete and patchy. The affection is, as a rule, temporary, and re-growth takes place when the disease is cured. The treatment suitable to those conditions will be described under the headings of the respective diseases.

There are other affections of the scalp which produce baldness as the result of atrophic and cicatricial changes, such as lupus erythematosus, tertiary ulcerating syphilides, small-pox, and sclerodermia. In these cases treatment is of no avail, as the cicatrisation usually involves the hair-follicles and papillæ, and regrowth is impossible.

Morbid conditions of the hair-follicles may also be responsible for baldness, such as those associated with keratotic changes at the mouth of the follicles, in which the orifice is constricted or completely blocked by horny plugs, for example, monilithrix and keratosis pilaris. The treatment of these affections is unsatisfactory. In the case of mild degrees of keratosis pilaris some benefit may be derived from scrubbing the scalp with soft soap on a piece of moist flannel, and the application of a 3 per cent. salicylic acid ointment.

Bald patches often occur as the result of the presence and action in and around the hair-follicles of certain hyphomycetic fungi and bacteria, such as those of ringworm and favus and ordinary pyogenic cocci. In the case of ringworm re-growth takes place when the ringworm is cured, but in favus the pressure of the scutula may lead to atrophy and cause permanent baldness. In the staphylococcic affections of the scalp associated with inflammation, exudation, and crusting, bald patches frequently occur. Re-growth takes place rapidly, however, when the inflammation subsides. The best treatment for those simple inflammatory conditions of the scalp is boric acid compresses, and the application of a 3 per cent. ammoniated mercury ointment. Should ulceration occur the papillæ may be so injured that re-growth is impossible.

The morbid conditions which are responsible for the great majority of these cases of baldness, however, are seborrhœa and pityriasis capitis, and the type of baldness produced by them is known as alopecia seborrhœica or calvities.

ALOPECIA SEBORRHŒICA OR CALVITIES.

t the present time there is some confusion with regard to the ꞉t diseased conditions of the scalp which are responsible for this ə of baldness. Of these there appear to be three, namely, seborrhœa, pityriasis capitis or dandruff, which are two distinct ties, differing in their clinical appearances and causation, and ımbination of the two to which the name seborrhoic derma- has been applied. These are responsible for the vast majority ases of progressive baldness, occurring prematurely about the of twenty, or appearing later in middle life. This type of lness is familiar to everyone. It begins, as a rule, on the ꞉ex of the scalp and the temples, and gradually spreads, the receding at the sides of the forehead, leaving a central tuft or pet, which in turn disappears, and at the vertex, forming a large l area occupying the crown of the head. The hair persists gest at the sides and at the occiput, where it forms a fringe, ing long after the remainder of the scalp has become bald, which in time may also disappear. The prognosis in this ə of baldness is as a rule unsatisfactory. A good deal can be e, however, by suitable treatment to retard the process, but e the condition has been established it is inevitably progres- . In commencing cases, if the hair has not entirely fallen , re-growth may be obtained by active treatment, but where baldness is well advanced treatment is of little avail; still, ꞉very case a thorough attempt should be made to cure it, in the e that if it does not arrest the defluvium it will at least retard progress.

'he treatment of this type of baldness is chiefly local, as the ction is not dependent to any marked degree on defects in general health. Of course any obvious impairment in health ch may be associated with it, as it will naturally increase the l process by reducing the general vitality, should be corrected suitable means, and the patient kept as healthy as possible a proper tonic and hygienic *régime*. There is, unfortunately, internal specific remedy which will make the hair grow. asionally pilocarpine has been known to do so, but, as its action ncertain and it is liable to produce toxic symptons, its employ- ıt is not advocated.

'he local treatment is of paramount importance, and varies ırding to the type of case. But whatever the type may be, the tment to be successful must be carried out with thoroughness perseverance. So often patients at the beginning employ local edies thoroughly, but in course of time through not observing any marked improvement are apt to become half-hearted, and to apply them by fits and starts, and many in their disappointment are liable to discard them altogether, and to fall into the hands of the vendors of patent nostrums, not realising that they are substituting for a carefully-thought-out line of treatment some cheap and often worthless lotion, fantastically labelled and sold at a great profit.

The different cases of seborrhoic baldness vary so much in type that each one must be treated on its own merits; but as a guide to the general method of treatment the cases may be divided for practical purposes into three groups, namely, (1) those in which the scalp is oily from seborrhœa or steatidrosis; (2) those associated with dandruff or greasy scales (pityriasis capitis); and (3) those in which well-marked inflammatory lesions occur (seborrhoic dermatitis).

(1) **In the oily type of case** the local treatment consists in the removal of the greasiness, and the stimulation of the scalp by washing it with soap spirit and the application of an antiseptic alcoholic lotion. A useful formula for the soap is: Sapo Viridis, ℥ij; Spirit. Vini Rect., ℥j; Ol. Lavandulæ, q.s.

This is allowed to digest for twenty-four hours, and is then decanted. For use, the soap-spirit may be mixed with warm water in the proportion of a tablespoonful to half a pint, and the scalp washed with it, or the undiluted soap-spirit may be rubbed into the scalp by means of a piece of moist flannel or sponge, and then rinsed out with warm water. Whichever way be adopted, it must be done thoroughly by parting the hair seriatim in different places, and rubbing the soap into the partings till the whole of the scalp has been gone over. Women with long thick hair find a difficulty in washing their own hair with the soap-spirit, and are apt to leave it so sticky that they have to employ egg-julep or ordinary soap afterwards to remove the stickiness. In such cases it is an advantage to have it shampooed by an attendant. The frequency with which the scalp should be washed depends upon the amount of greasiness, but on an average it should be done about once a week in men and once a fortnight in women.

In addition to the washing, a stimulating spirit lotion should be rubbed in by a piece of flannel twice a day. This lotion should contain some drug with a keratolytic action, such as resorcin or salicylic acid, to remove the epithelial *débris* about the mouths of the follicles, and allow the spirit to penetrate more deeply, and some parasiticide to destroy or prevent the growth of micro-organisms in the oily sebum. The following will be found to be a serviceable formula: Resorcin., gr. 15; Hydrag. Perchlor., gr. 1; Spiritus Vini

Rect., ʒiv; Aquam Rosæ, ad ℥j [U. S. P. Resorcini, gr. 15; Hydrargyri Chloridi Corrosivi., gr. 1; Alcoholis, ʒiv; Aquam Rosæ, ad ℥j].

Instead of the rectified spirit, eau de Cologne may be substituted; in the case of males glycerine ♏10 should be added, and in fair-haired people salicylic acid should be used instead of resorcin as the latter is apt to stain the hair a rusty colour. To render the lotion more stimulating, acetic acid ʒss, or ammonium chloride 3 gr., may be added. A lotion made on the above lines should be cooling to use, and should produce a stinging feeling when applied. After the special modification of the lotion, which is most pleasant to the individual, has been arrived at, its use should be continued indefinitely. The following nascent sulphur lotion was recommended by Crocker for these cases, and gives good results; No. 1: Sodii Hyposulphitis, ʒiij; Eau de Cologne, ℥j; Aq. Dest., ad ℥viij. No. 2: Acid. Tartaric., ʒss; Aq. Dest., ad ℥viij.

For use, lotion No. 1 should be rubbed in with a sponge for a few minutes, and No. 2 applied subsequently to the same area.

(2) In the second type of case, where the most marked feature is the presence of **scales or dandruff** (*alopecia pityrodes*), more energetic treatment is necessary. When the dandruff is slight, it may be kept under by washing the scalp with soap-spirit and applying the above-mentioned resorcin lotion. As a rule, however, lotions are insufficient and ointments have to be resorted to. The discomfort associated with the use of ointments and pomades, especially in women, is considerable, so that in the first instance a non-greasy brilliantine should be tried, as it is less disagreeable to use than an ointment. Such can be made with castor oil, as it is soluble in spirit, and the following formula is useful: Acid. Salicylic., gr. 15; Ol. Ricini, ♏20; Spirit. Vini Rect., ℥j.

This may be made more pleasant by the addition of a few drops of ol. ros. geran. or a teaspoonful of eau de Cologne. The brilliantine should be rubbed into the scalp daily and the hair washed once a week.

When the hair is thickly covered with greasy, waxy scales, by far the best results, however, are obtained by the employment of ointments containing the same active principles as the above lotions, such as the following: Acid. Salicyl., gr. 10; Sulphur. Præcip. vel Hydrarg. Ammoniat., gr. 15; Paraffini Mollis Albi, ℥j.

Instead of the soft white paraffin a pomade basis may be substituted, such as the following: Ol. Cocao, ʒss; Ol. Amygdalæ, ℥j; Ol. Rosæ Gutt., q.s.

The pomade being thicker in consistence than the vaseline is especially useful in hot weather.

When the scales are thick and waxy, tar applications are of service, such as: Resorcin., gr. 20; Ol. Cadini, ʒj; Paraffinum Molle, ad ℥j.

One or other of the above ointments or pomades should be thoroughly rubbed into the affected region every night and the scalp washed with soap-spirit in the morning, and after drying the resorcin spirit lotion should be applied. This treatment should be kept up so long as any scales are present. In moderately severe cases it is usually sufficient to apply the ointment and to wash the scalp once a week, while the lotion is rubbed in daily. In severe cases, however, it may be necessary to rub in the ointment and to wash the scalp every other day. Where the scales are so thick as almost to amount to crusts, it is advisable to soften them with olive oil as a preliminary to washing the scalp. When frequent washing is necessary, instead of the soap-spirit a weak solution of borax containing a teaspoonful to a pint of water may be employed to remove the grease.

(3) In the third type of case (**seborrhoic dermatitis**), where marked inflammatory changes occur and where the scalp is not only covered with greasy scales but may be œdematous and even eczematised, before a routine treatment with washing and the application of one or other of the above ointments is adopted it is necessary to reduce the inflammation. Should this not be done, there is a danger of aggravating rather than of allaying the disease. For this purpose lead lotions are especially valuable, such, for example, as the glycerine of the subacetate of lead, a teaspoonful to half a pint of water, employed several times a day in the form of a compress. The action of the lead may be augmented by the addition of half a teaspoonful of the liquor carbonis detergens. When by this means the inflammation has been reduced, the treatment described above should be resorted to.

J. M. H. MACLEOD.

BLASTOMYCETIC DERMATITIS.

The only drug which has any effect on this disease is that which is usually given for most of the infective granulomata, namely, potassium iodide. It is necessary, however, to give it in large doses before any effect is noticed. If the patient stands 5 or 10 gr. three times a day satisfactorily, the amount should be rapidly increased until ½ drachm, or more, is given at a dose. Usually when the total reaches 100 gr. in the twenty-four hours, some effect will be seen on the ulcers, which gradually heal up and disappear. Unless there are any indications to the contrary, these doses should be continued for a month, then left off for a month, and then repeated, even though the lesions are healed.

Local treatment consists in the application of the ordinary mercurial or other antiseptic ointments to keep the ulcers clean ; but in those cases in which potassium iodide is not effective fairly early it is advisable to excise the lesions which are suitable for excision, and scrape the larger ones, applying some caustic, either the electro-cautery or silver nitrate, afterwards.

WILFRID S. FOX.

BOILS OR FURUNCLES.

Boils are caused by the action of staphylococci situated in and around the deeper portion of the pilo-sebaceous follicles. They are the result of the inoculation of micro-organisms which have penetrated deeply into the hair follicle or sebaceous gland and have there proliferated to form a colony. In consequence of their presence a more or less acute reaction takes place on the part of the surrounding tissue to destroy and limit the sphere of action of the invaders. This results in the formation of a swelling due to dilatation of the neighbouring capillaries, œdema, and a cellular infiltration around the microbic focus, which gradually undergoes necrosis in the centre, with the formation of pus and the production of the clinical appearances associated with a boil. The micro-organisms which are responsible for the condition are the Staphylococcus pyogenes aureus and albus. These have been inoculated locally and have not been carried to the skin by the blood-stream. But though the affection is due to a local inoculation, the state of the blood of the individual affected is also an important factor in the causation of the lesions, in rendering the soil suitable for the growth of the micro-organisms and determining the manner of reaction of the tissues. The initial inoculation may be the result of a scratch or abrasion, or it may be caused by friction and rubbing, as in the case of boils at the back of the neck from chafing of the collar, or those which occur in the buttocks of oarsmen. They may also result from inoculations taking place in connection with various forms of skin affections associated with scratching, such as eczema, scabies and pediculosis.

Any condition of depressed vitality may be a predisposing factor in causing and perpetuating boils. They commonly occur in association with diabetes, Bright's disease and septicæmia, and in convalescence after some serious illness. They are not infrequently met with in persons who are run down from anæmia, digestive disorders with constipation, and the absorption of toxins from the alimentary tract, improper or insufficient food, alcoholism, insanitary surroundings, or in those who are exposed to the effluvia from bad drains. When they are the result of a simple traumatism and inoculation in an individual whose resistance is high, they may be single, but should the general vitality be impaired the affection is, as a rule, perpetuated by the occurrence of successive crops.

The ultimate prognosis is satisfactory, though the time taken to cure the affection varies indefinitely in different individuals. When only one or two boils exist and the general health of the patient is good, a cure may be effected in the course of a week or two. Should they occur in situations where the hairs are long and the tissues tough, such as at the nape of the neck, in spite of the fact that the individual's general health may be good, fresh boils are liable to appear, owing to the mechanical difficulty of eradicating the deeply seated condition by local treatment, and owing to repeated inoculations taking place by the rubbing of the collar. On the other hand, when they have developed in an individual whose vitality is depressed and are occurring in successive crops, the immediate outlook is unfavourable, and a more or less tedious and prolonged course of treatment may be necessary before the affection is finally got rid of.

In the treatment of boils two considerations have to be kept in mind: (1) The destruction of the microbes and the removal of their effects, and (2) the rendering of the tissues an unfavourable soil for the further spread of the disease by suitable general treatment.

General Treatment.—Any defect in the general health should be carefully sought for and treated. The urine should be examined for albumen and sugar, as boils are a frequent accompaniment of Bright's disease and diabetes. These must be dealt with on general medical principles. Digestive disturbances, especially constipation, must be corrected. In cases where the boils occur in anæmic, overworked individuals, much benefit can be derived from a proper tonic *régime*, with change of air, exercise and tonics containing iron and strychnine. In those who have suffered from malaria quinine is of special value. In short, any debilitating influence must be treated by suitable measures, dietetic, medicinal and hygienic.

There are two internal remedies which have for long been regarded as possessing a specific action in reducing pustulation. These are sulphur and yeast.

Sulphur may be prescribed in the form of the lozenge, or as half to one teaspoonful of sublimed sulphur every morning. The favourite method of administering it, however, is in the form of the sulphide of calcium. According to Ringer, who highly recommended this drug, it should be given as a powder in doses of $\frac{1}{10}$ to $\frac{1}{2}$ gr., mixed with sugar of milk every two hours or oftener, and as the preparation readily becomes inert from oxidation and decomposition, it should be made freshly every day or prescribed in the form of coated pills. The action of the sulphur, which is of undoubted value in certain people, is probably in part due to the fact that it is excreted in the sweat and in passing through the skin acts as an antiseptic, and partly to its mildly laxative action.

Yeast has also been employed in this connection, and has recently regained its popularity. It may be given in doses of a teaspoonful or more of fresh brewers' yeast in water thrice daily at the beginning of a meal. Larger doses may be prescribed, but this should be done with caution, as it tends in some patients to produce diarrhœa and colic, and its smell and taste are unpleasant. Instead of yeast itself certain extracts have been introduced which do not so readily cause disagreeable symptoms, and have the advantages of being more stable in their composition than yeast itself, and capable of more accurate dosage, such, for example, as nuclein and ceridine.

Nuclein is the most important of the nitrogenous constituents of yeast, and may be given in the form of subcutaneous injections, or by the mouth in doses of one to two teaspoonfuls of nuclein solution in a wineglass of water three times daily between meals and at bed-time.

Ceridine is a fatty constituent of yeast, and is given in doses of ·1 gramme in pill form three times daily.

These preparations of yeast occasionally act beneficially, but, like yeast itself, their action is by no means certain. They have been said to have a certain degree of bactericidal power, and to cause a temporary leucocytosis with an increase in the opsonin content of the blood, but they act also by being mild aperients.

Vaccine Treatment.—Staphylococcus vaccines have been extensively employed of late for the treatment of boils, and in acute cases with considerable success. In suitable cases of furunculosis vaccine treatment probably gives better results than it does in any other skin affection for which it has been advocated. A vaccine is either specially prepared from the patient's own staphylococci, or a stock vaccine is employed, but in most cases the latter is sufficiently effective. It is unnecessary to control the injections by the estimation of the opsonic index, because should the treatment be unsuitable the fact is indicated by the eruption of fresh lesions. In acute cases an initial dose of 100 millions should be given. The patient should be seen four days later, and if he is improved or remains *in statu quo*, a further dose of 250 millions may be injected, which may effect a cure. On the other hand, in cases of chronic furunculosis, the treatment is not generally so successful. An initial dose of 100 millions should be given, followed in a week by a dose of 200 millions, and so on, with a weekly increase of 100 millions, until a maximum dose of about

500 millions has been reached. In these cases fresh outbreaks of lesions may occur, in spite of the treatment, or after a temporary improvement has taken place.

The injection should be made into the subcutaneous tissue of the thigh, shoulder, or back, and should be done with the usual aseptic precautions. It acts by increasing the protective substances in the blood and inducing phagocytosis. In chronic cases the cause of failure may be that, owing to the chronicity of the disease and the continued presence of numbers of staphylococci in the tissue, the power of resistance of the individual's serum has already been fully stimulated. (*See also* Vaccine Therapy, p. 291).

Local Treatment.—Local treatment is of more importance than any form of general or internal treatment, and even in those cases in which vaccine treatment is being employed healing is facilitated by combining it with suitable local measures. In certain cases local treatment is all that is required for the cure of the lesions, but as a rule the best results are obtained by a judicious combination of both local and general methods.

The local treatment varies according to the size, situation and stage of evolution of the boil. If the boil is in the early indurated stage and there is no evidence of central softening or pointing, it should be fomented with hot boric acid compresses, changed frequently, or when situated on the hands or feet by immersing the part in a hot boric lotion bath. This treatment should be continued assiduously till softening takes place and signs of pointing appear, when it should be incised by a fine tenotome, the pus allowed to well out, and the cavity washed out by the injection of 1 in 30 carbolic acid lotion by a hypodermic syringe. It should on no account be opened in the hard stage, nor when opened should it be squeezed. When it is discharging, boric fomentations should still be continued, but every time a fresh one is applied the lesions should be bathed with 1 in 4,000 corrosive sublimate lotion, and to prevent the infection of the surrounding skin by the discharge the neighbourhood for a distance of an inch or more around the boil should be painted with tincture of iodine. Instead of hot boric compresses, good results can also be obtained by applying pads of cotton-wool saturated in carbolised glycerine (1 in 8), and covered by guttapercha tissue.

Another form of treatment which gives good results if properly carried out has been suggested by Gallois, and consists of painting any unbroken boil with a solution of iodine (2 parts) in acetone (5 parts), and applying a pad of lint wrung out in boiling water and saturated in glycerine to the affected area. This is covered with a layer of cotton-wool and a bandage, the dressing being changed twice a day.

A form of local treatment which occasionally gives good results, and may be safely entrusted to the hands of an intelligent patient, is that by Bier's cupping glasses, which act by producing a hyperæmia and an increase in the amount of protective substances in the serum. When the glass is applied, the degree of suction should be just sufficient to cause discomfort without actual pain. It should not be applied continuously, but should be put on for five minutes, then removed for a few minutes, re-applied, and so on intermittently for an hour once or twice a day. This treatment is of special value when the boil has matured and has been incised, for by it the discharge of pus is facilitated, sloughs are separated, and healing is accelerated.

Several methods have been suggested with the object of aborting boils, and causing them to resolve without suppurating. Of these one of the most effective is to paint the lesion with collodion containing 5 per cent. of iodoform every four hours. Other useful methods have been recommended for this purpose, such as the injection of a few drops of pure carbolic acid into the centre of the lesion, or the application continuously of mercury and carbolic plaster.

The reason why the local treatment of boils is so often discouraging and new lesions keep on developing in spite of it is simply the mechanical difficulty of reaching microbes situated deep down in the follicles by parasiticides locally applied. In ordinary impetigo the cocci are superficial and easily got at, but in boils and carbuncles it is practically impossible to reach them by surface applications.

One of the most troublesome positions in which furunculosis occurs is the back of the neck in men, for there, owing to the chafing of the collar, the affection is liable to be spread and the disease perpetuated. In such cases silk or flannel collars should be substituted for stiff linen ones, or a soft hunting-stock should be worn. On the whole, the most useful treatment for this condition is the perserving application of hot boric acid compresses. When the skin has become markedly indurated, and the affection seems to have reached the stage of chronicity in which the compresses seem to have lost their beneficial effect, improvement may be obtained from the application of Finsen light exposures, given in the same manner as for the treatment of lupus vulgaris. This produces an inflammatory reaction with marked reduction of the induration when it subsides. The X-rays are also of value in these cases, a full

Sabouraud pastille dose being given, and repeated in a month if necessary. The X-rays should not, however, be employed in acute cases, as they are liable to produce an exacerbation of the inflammatory disturbance, which may last several weeks before subsiding.

In every case of boils it must be borne in mind that not only is it necessary to treat the individual lesion, but it is equally important to render the neighbouring skin as unsuitable a soil as possible for the further spread of the disease by painting it with tincture of iodine, or by rubbing in daily a 3 per cent. ammoniated mercury ointment.

J. M. H. MACLEOD.

CARBUNCLES.

The exact pathogenesis of carbuncles is not fully understood. Like boils, they are caused by the local inoculation of certain cocci at the pilo-sebaceous follicles, but the reason why in the one case the lesions should be limited and confined to one follicle and in the other they should be more diffuse and affect several contiguous follicles is not quite clear. It has been suggested as an explanation for the more virulent characteristics of the inflammatory process in carbuncles than boils that the former may be due to another type of micro-organism, possibly a streptoccocus. Up to the present time this suggestion has not been authenticated, and the organism which is invariably found, and which must be provisionally regarded as the cause, is the ubiquitous Staphylococcus pyogenes aureus. Histologically it is found that the diseased process, instead of being more or less circumscribed around the follicle and confined to the corium as in a boil, occurs more deeply in the subcutaneous tissue and spreads latterly in the lines of least resistance between the fibrous bands and the groups of fat cells, and is limited by denser sheaths of fascia. The carbuncle is altogether a more acute phlegmonous process than the boil, and is associated with sloughing of the tissues and occasionally with gangrene. This may be the result of the low vitality of the individual inoculated, who forms a peculiarly suitable soil for the microbe, as it is found almost invariably in association with severe constitutional depression, such as occurs in diabetes, Bright's disease, septicæmia, malaria and other debilitating conditions. The prognosis should always be guarded. Suitable treatment as a rule effects a cure, but unless radical measures are adopted the course of the affection may be often indefinitely prolonged. In elderly people with diabetes or albuminuria the outlook may be extremely serious, and the patient's life may be endangered from exhaustion or septicæmia. In those rare cases also of malignant carbuncle on the lip, fatal results have occured as the result of septic phlebitis, sinus thrombosis and meningitis.

General Treatment.—The general treatment is based on ordinary medical principles. In every case an examination of the urine should be made for sugar or albumen. When glycosuria is detected, opium is indicated in doses of 1 gr. three times daily, or

2 gr. at bed-time, as it not only relieves the pain and induces sleep, but has a valuable action on the diabetes. The pain associated with the affection is often so considerable that sedatives are demanded, and of these bromides and chloral hydrate are of value; opium, except in diabetes, is better avoided, and especially in cases of albuminuria. Formerly when the favourite treatment for this condition was crucial incisions and a stimulating *régime*, it was customary to prescribe alcohol in the form of burgundy and port, to insist on a most generous diet, and usually to lay the patient up. This treatment has now given place to a more rational one, consisting of ordinary diet, the avoidance of alcohol, as it only increases the tension in the lesions, ambulatory treatment rather than confinement to bed, fresh air, exercise and tonics, such as iron, strychnine and quinine.

Vaccine Treatment.—Vaccine treatment has given good results in this condition, the injections being similar to those employed for the treatment of boils, namely, an initial injection of 100 millions of a stock staphylococcus vaccine, followed by an injection of 250 millions in four or five days. At the same time boric compresses should be applied to the lesion, and it should be protected in the intervals by pads of cotton-wool. Benefit has also been derived from injections of anti-diphtheritic serum and anti-streptococcus serum. This does not necessarily indicate that the lesions are due to streptococci, as staphylococcus infections are also improved by anti-streptococcus serum. Recently horse serum given by the mouth has been employed for the treatment of this affection, and improvement has been recorded from its use. (*See also* Vaccine Therapy, p. 291.)

Local Treatment.—By far the most satisfactory method of treating carbuncles locally is to eradicate them by excision or scraping, and even large lesions can be dealt with in this fashion. After the diseased tissue has been removed by the curette, scissors or scalpel, the surface should be thoroughly swabbed with an antiseptic lotion, such as 1 in 20 carbolic, and allowed to granulate up under suitable dressings. Various abortive measures similar to those which have been described in connection with boils have been suggested with the object of arresting the diseased process, such as painting the lesions with iodoform-collodion (5 per cent.), or the injection of carbolic acid, but these, except in slight cases, are of comparatively little value. When for some reason or other, such as the age or debilitated condition of the patient, a radical operation is contra-indicated, milder measures may be resorted to, such as the old-fashioned treatment of applying lead plasters with

a hole cut in the centre and fomenting with hot boric lotion, a
when the core has separated, syringing the lesion with carb
lotion and plugging it with carbolised gauze. Instead of the l
plaster, mercury and carbolic plaster may be employed, or
lesion may be covered continuously with carbolic ointme
2 per cent., thickened with starch or zinc, and spread on lint.

J. M. H. MACLEO

CHEIROPOMPHOLYX.

Although it is not invariably the case, one frequently finds that in this condition benefit is derived from general tonics, and of these cod-liver oil and iron are most regularly used.

The writer has had best results from ½-gr. doses of quinine, given thrice daily if the digestion can stand it, and if not he prescribes a mixture containing sodium bicarbonate and tincture of nux vomica.

Local treatment in early cases consists in the free use of a dusting-powder composed of 3 per cent. of salicylic acid in talc. If not sufficient, the following paste should be applied at night in addition : ℞. Zinci oxidi, pulv. amyli, adipis lanæ hydrosi, paraffini mollis albi, partes æquales. It is important that this salve should be spread thickly on strips of linen and wound round each finger individually. The old ointment can be removed by rubbing with olive oil, and the application can be repeated twice daily in more severe types. When the lesions are not very moist, Hebra's ointment is even better, but its employment is apt to be followed by the outbreak of pustulation at the edge of the bandages in certain individuals. If carefully watched, however, and discontinued on the slightest sign of this complication, this remedy (equal parts of lead plaster and vaseline) is very effectual.

In more advanced cases, where there is secondary infection and crusting, boracic starch poultices yield the best results if properly made and applied. They should be stiffly gelatinous in consistence, quite half an inch thick, covered with a layer of cheese-cloth on the side next the skin and changed four hourly, the parts being cleansed with wool before each fresh application.

Instead of this, one may soak the parts for a night in olive oil, and after swabbing apply the zinc paste mentioned, with the addition of 5 gr. of hydrarg. ammoniat. to each ounce.

A very moist stage is advantageously treated by painting every day or every second day with a solution of 15 gr. of silver nitrate to 1 oz. of spiritus ætheris nitrosi.

The redness left after the eruption has subsided must be carefully treated and tar is best for this. Other preparations of tar will be described under "Eczema," but a good one for these cases is ℞. Picis carbonis, 10 ; benzol, 20 ; and acetone, 70 parts.

Recurrences are common, but they are much more so if the patient is allowed to use the hands while still erythematous and susceptible to irritation.

For the excessive perspiration, so often a precursor of this disease, the use of X-rays is often beneficial.[1] When the X-rays are not available, dusting with tannoform or bathing frequently with 1 in 1000 corrosive sublimate in rectified spirit is often curative.

F. GARDINER.

REFERENCE.

[1] Pirie, A. Howard, Brit. Med. Journ., Lond., 1910, II., p. 522.

CHLOASMA.

This being a manifestation of some internal disturbance, it is evident that one must endeavour to find the cause; all the organs must therefore be examined and the suitable medical treatment adopted. Most commonly the liver, kidney, uterus or ovaries are affected. If pregnancy is a factor, we must await its term.

Local treatment is uncertain; if the pigment is superficial it can be removed, but if deep, only improvement at the most can be expected. A lotion of 1 in 500 corrosive sublimate applied frequently, repeated scrubbings with soap spirit, the application of 10 per cent. of resorcin in vaseline are all of value, but they only act by removing the horny layers and the upper part of the rete, although they may promote absorption in the deeper layers.

Crocker used 2 gr. of corrosive sublimate in 1 oz. of almond oil emulsion.

Recently the use of carbonic acid snow has come into use in these cases, and the effect is very satisfactory. In superficial varieties an application for 20 seconds is long enough, but in deeper types longer may be required.

F. GARDINER.

CHELOID AND ACNE CHELOID.

The selective action which radium has for young pathogenic fibrous tissue renders it a particularly satisfactory treatment for this disease. By interposing a suitable filter of aluminium or lead the α-rays and the soft β-rays are eliminated, only the hard β and γ-rays being used. In this way the hypertrophic fibrous tissue can be destroyed without producing very much local inflammatory reaction. The resulting scar is flat, supple and inconspicuous.

X-rays, given in large doses at long intervals, give almost equally good results, but as a rule do not act so quickly as radium. The exposures should be given at fortnightly intervals, and consist of a three-quarter Sabouraud dose, that is to say, the *teinte* B judged by electric light (*see* Ringworm). No dressing is required between the treatments.

Scarification, when neither of the above-mentioned methods are available, gives very fair results. The incisions are best made with a Vidal knife, parallel and close together, going through the whole thickness of the growth, and then similar ones repeated at right angles. Unless the lesion is extensive, it is not as a rule necessary to give a general anæsthetic. The surface should be carefully cleansed beforehand, and the wounds should be dressed with boracic ointment until healed.

Injections of thiosinamin in the neighbourhood of the growth give fairly satisfactory results, especially when one is dealing with large hypertrophic scars after burns or scalds. The treatment is, however, extremely painful, the pain continuing for several hours after the injection. Fibrolysin, a modification of thiosinamin, is less painful, but does not appear to be so active. The thiosinamin solution is made up as follows: Thiosinamin, gr. 8; Glycerine, ♏20; Distilled Water to ʒij. It requires gentle heating to give a clear solution. Ten minims should be injected beneath the scar once or twice a week, according to its effect upon the patient.

Electrolysis will sometimes give fair results, but is not specially applicable to this disease.

WILFRID S. FOX.

CHILBLAINS.

The treatment of chilblains consists in combined stimulation of the circulation both locally and centrally, together with the relief of the pruritus. The patient should be warmly clad, not only at the extremities, but the limbs throughout their whole length should have ample protection against cold; thick gloves and stockings should be worn, and the boots should be sufficiently roomy to allow movement of the toes. It is useless to wear gloves if the wrists and forearms are left bare. The patient should take active exercise, running or skipping being useful in the case of children. The hands should always be washed in hot water, thoroughly dried afterwards, and rubbed vigorously with a towel. The diet should be ample, children being encouraged to take milk and cream in addition to the ordinary meals. A damp, cold climate should be, if possible, avoided, dry cold often having a stimulating effect which cures the chilblain. In this way it is often seen that a boy or girl who comes back from school in the winter holidays suffering from bad chilblains will often lose them if taken to one of the winter resorts in Switzerland, or elsewhere where the cold is dry.

If these general suggestions are carried out early in the winter, one is frequently able to prevent the appearance of this perennial trouble.

The drugs which are of use internally are iron and strychnine tonics; ichthyol in capsules (♏5 to 10 three times a day); opium in five min. doses of the tincture; calcium lactate (10 gr. three times a day) when the blood is found to have a diminished coagulative ability; nitro-glycerine in the form of tabellæ trinitrini (one three times a day for an adult).

Locally, anti-pruritics and stimulants should be applied. Of these friar's balsam and the iodine compounds appear the most effective. They may be given in the following form: Tinc. Benzoin Co., Menthol (equal parts).

Of the iodine compounds the best is vasogen iodine, 10 per cent. or stronger, in liquid paraffin. This has the advantage of not staining the skin.

Tincture of iodine, painted on twice daily, is satisfactory as regards the feet, but the staining of the skin is a drawback as far as the hands are concerned.

Ichthyol in a 10 per cent., or stronger, cream, may be rubbed in locally twice daily, and in the interval may be applied on strips of lint wrapped round the fingers. It is particularly useful in controlling the intense hyperæmia and burning sensation. Equal parts of linimentum camph. co. and linimentum belladonnæ is also a useful preparation.

High frequency currents given on the hands and feet from a brush electrode give considerable relief to the pain and itching, but require to be repeated several times before any permanent effect is produced.

When the chilblain is broken it must be treated on ordinary surgical lines. Hot boracic fomentations should be applied every four hours, and the parts kept warm and at rest. Later, boracic ointment may be used, and the general prophylactic treatment as described above carried on at the same time.

WILFRID S. FOX.

CHROMIDROSIS OR COLOURED SWEATING.

In this rare condition the sweat may be black, blue, green, red or yellow in colour. Before deciding on the line of treatment, the possibility of the colouration being due to dye from the clothes or stockings should be carefully considered and eliminated.

In cases in which the sweat is black or blue in tinge, the patients are usually women of the neurasthenic type and the treatment consists in improving the general health by suitable measures, special attention being directed to the gastro-intestinal tract to avoid the excessive formation of indol, which might be connected with the pigmentation. When the sweat is red or yellowish in tinge, it is believed to be due to the presence of certain bacteria, and the treatment consists of bathing the affected skin once or twice a day with 1 in 1000 perchloride of mercury solution. Red sweat is not infrequent in the axillæ and is then generally associated with concretions in the hairs (*see* Leptothrix).

J. M. H. MACLEOD.

COMEDONES.

The familiar comedo, or blackhead, is a small oat-shaped plug consisting of horny and sebaceous material blocking a pilo-sebaceous follicle. The removal of comedones is important for two reasons: first, on account of the disfigurement associated with them; and second, because they are apt to become inflamed and transformed into acne pustules. They generally appear about puberty, and tend to disappear spontaneously in early adult life. They may appear later, however, even in elderly people, and occasionally occur in groups in infants and young children. Their exact pathogenesis is not fully understood. Many observers consider that they are due to the action of the micro-bacilli of Sabouraud on the skin affected with oily séborrhœa. This may hold good for the majority of cases, but it does not explain the comedones of infancy in which these micro-organisms cannot be found. Where the comedones are few there is comparatively little difficulty in getting rid of them, but where they are numerous considerable perseverance may be required as they continue to re-form after removal. When they occur in young people apparently in robust health no general treatment is necessary, but in a large number of cases they are associated with some general derangement, such as scrofula, anæmia, indigestion, constipation and liver disturbances, which requires to be treated on general medical principles. The oily seborrhœa which forms the soil on which the comedones grow may be an in-born peculiarity, or it may be connected with one or other of the above general derangements, and should be dealt with accordingly.

The **local procedure** for the removal of blackheads is as follows. When they are few in number and small in size, they may be easily expressed by squeezing the skin on which they are situated between two fingers or by an old-fashioned watch-key. These procedures, however, are apt to be ineffective and to cause inflammation around the partially removed blackheads, and by abrasion of the skin and the inoculation of pus organisms to produce pustulation. When they are numerous, or when they occur in inaccessible situations such as the back, it is impossible to remove them oneself. As a prelude to their removal the skin should be softened by hot boric acid compresses, steam from a bronchitis kettle, or when they occur about the back and chest, by lathering with soft soap in a hot bath.

The patient should then be placed in a good light on a couch or chair opposite the window and the comedones systematically expressed by a "comedo expressor." Of these there are numerous patterns, one of the most useful being a curved instrument with a small spoon at each end perforated by a hole, the opening at one end being slightly larger than the other to suit the different sizes of comedones. The convex side of the spoon is pressed down firmly on the comedo, with the result that it is forced out and passes up through the opening into the spoon. Occasionally when the comedones are large and tightly fixed their removal is facilitated by pricking the apex of the lesion by a fine-pointed scalpel. After their removal the skin should be rolled between the finger and thumb, or massaged with the fingers dipped in olive oil, in order to remove any smaller blackheads, or greasy plugs, or "cocoons" which may be left. After the massage a dusting powder containing equal parts of precipitate of sulphur and talc, or the following sulphur lotion may be applied: Sulphur. Præcip., ʒjss; Camphor., ʒss: Spirit. Vini Rect., ʒij; Aq. Rosæ, ad ℥ij.

The **X-rays** have also been used for the destruction of comedones when they are particularly numerous and prominent about the face, and if carefully employed give good results. A full Sabouraud pastille dose should be given at the regulation distance of 15 centimètres. This produces a temporary atrophy of the pilo-sebaceous follicles, causing a shedding of the comedones, and reduces the thickening in the intervening epidermis.

Recently the treatment of comedones by injections of **vaccines** prepared from the micro-bacillus of Sabouraud has been employed, but with doubtful results. Until the micro-bacillus has been definitely established as the cause of the affection, it is wiser to continue with the older and more certain methods before resorting to such bacteriological experiments. (*See* Acne Vulgaris.)

J. M. H. MACLEOD.

CORNS.

THE treatment of corns will depend on whether the corn is inflamed or not. When dealing with a corn which is suppurating, especially after it has been cut with a dirty knife, which is the usual method of infection, the practitioner must treat it on the lines of any other septic lesion, that is to say, with hot boracic fomentations or hydrogen peroxide fomentations. It is also advisable to keep the limb elevated and at rest until the septic process is eliminated, for it should not be forgotten that the consequences of a suppurating corn may be serious.

When the corn is not inflamed there are two methods of treatment which are open to the practitioner:

(1) *Complete Destruction of the Corn either by Excision of the Whole Corn or by the Electro-Cautery.*—The latter plan is usually the more satisfactory, and can be carried out quite well under a local anæsthetic, preferably novocaine and adrenalin. The fine point of the electro-cautery must be pressed down deeply into the central core of the corn. In this way a corn which may have been a source of trouble for years can be completely and permanently removed.

(2) *Gradual Exfoliation of the Corn and Removal of the Dead Parts with a Scalpel.*—This is effected by means of a 20 per cent. salicylic plaster, or salicylic acid in collodion, a drachm to the ounce. The dead horny matter is then cut down with a knife until the process becomes painful, and then the operation is repeated. Liquor potassæ may be used as a solvent of the horny matter in place of salicylic acid, and should be painted on with a brush twice daily, the surrounding skin being protected with vaseline. By this means the corn can gradually be worn down until the root is eliminated. The process, however, is often not permanent, and the operation has to be repeated about every three months.

The method of exfoliation by means of solid carbon dioxide (*see* Nævi) may be used in some cases with success, but the exposure must be long, generally for a minute or more, and is very difficult to gauge in any individual case; also the after-pain may be very severe.

Soft corns between the toes may sometimes be cured by the simple method of wearing a small wad of cotton-wool soaked in castor-oil, replacing it twice daily. When this fails, the soft corn must be treated on the same lines as the hard.

In the treatment of corns it should not be forgotten that the wearing of suitable boots is the most potent factor in preventing recurrence, the commonest fault being pressure of the great toe outwards instead of the line of the foot on the inner side being straight; this forms an obtuse angle opposite the head of the metatarsal bone of the great toe, and produces in consequence a corn on the surface and a synovitis or bursitis below, the combination being the ordinary bunion. In addition, the outward pressure of the great toe by crowding the other toes together closely raises one of them above its fellows, and produces a corn on the most prominent joint of this elevated toe. The boots, therefore, should be made straight on the inner side.

Callosities, that is to say, raised areas of hyperkeratosis, differ from the ordinary corn in that they are usually much more extensive in surface and have no central root or "nail." They are in consequence usually painless, and if treatment is required they can easily be removed by salicylic acid plasters or liquor potassæ as described above.

WILFRID S. FOX.

DARIER'S DISEASE.

(*Synonyms.*—Keratosis Vegetans, Psorospermosis Follicularis Vegetans.)

There is no internal treatment which appears to have any really satisfactory effect on this disease. Arsenic has been given, but the benefit appears to be doubtful. Externally it may be treated in a palliative method on the lines of a seborrhœic condition, that is to say, with sulphur and salicylic ointment: (℞. Sulphur. Præcip., gr. 15; Acid. Salicyl., gr. 10; Adipem Benzoatum, ad ℥j); or an attempt may be made to eradicate the whole condition with the galvano-cautery. The most important point is to keep the patient clean and free from foul discharges arising from these greasy, wart-like growths, especially in the axillæ and flexures. This is best done by frequent alkaline baths, and powdering afterwards with astringent and disinfecting dusting powders; of these bismuth subgallate, or equal parts of boracic acid and zinc oxide, will be found effective. The red sulphide of mercury is also useful in the form of an ointment (10 gr. to 1 oz.).

WILFRID S. FOX.

DERMATITIS ARTEFACTA.

It is difficult to separate clearly some cases of insanity from hysteria, and this eruption occurs in both these types.

Protection of the patient from him or herself is the keynote of treatment. To this end it is important to find out the means used for the self-infliction. Anyone who has had to deal with these cases will agree that this is no easy matter, and it often only can be done after removal of the patient to a nursing home or hospital.

Friction and the use of corrosive drugs are the most common irritants employed, and the linear and unnatural appearance of the eruption, coupled with its appearance on regions within the reach of the patient's hands, should be borne in mind in clinching the diagnosis. After finding the cause, the rest is comparatively easy.

Zinc-ichthyol jelly is very useful, as it at once protects and indicates any interference on the part of the patient.

Otherwise the lesions can be healed up under the use of any simple soothing ointment, such as a zinc paste.

F. GARDINER.

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DERMATITIS HERPETIFORMIS.

From the standpoint of internal medication this disease is best regarded as a toxæmia. A course of milk diet, followed by the free use of vegetables, or, better still, a purely vegetarian diet, works wonders in some cases. Diluents have been recommended, and if the patient can be persuaded to drink several pints of water daily, together with some mild mineral water, benefit is generally obtained.

As the above treatment indicates, free excretion is desirable, and therefore aperients must be given if necessary.

Calomel has proved of value, chiefly in children. Occasionally one sees success following the use of intestinal disinfectants, such as salol or beta-naphthol, and it may be tried in the event of other remedies failing.

Arsenic is our best drug in most cases, and when used it should be pushed until benefit is obtained and then stopped. Sometimes this remedy fails, and then ichthyol (in 5 or 10 minim doses) should be tried. Personally I have found this most satisfactory in the erythematous type.

Locally the chief point is to use remedies which are soothing and at the same time mildly antiseptic, as the spread of pustulation in this disease is a serious matter, and apt to be followed by the onset of pemphigus foliaceus.

℞. Bismuth. oxychlorid., 10 gr.; paraffini mollis albi, 1 oz.; or ℞. Hydrarg. ammoniati, 5 gr.; paraffini mollis albi, 1 oz.; or ℞. Ichthyol., 10 gr., zinci oxidi, pulv. amyli, adipis lanæ hydrosi et paraffini mollis albi, āā 2 drachms, are examples of satisfactory applications.

X-rays are of value in some localised types, but are not very suitable for eruptions covering the whole body. Half a pastille dose, repeated once a week, is the average dose.

Recurrences are very common, and as it is difficult to be certain of a cure, the patient should be instructed to avoid worry or excitement, and adopt the usual measures for a healthy life.

F. GARDINER.

DERMATITIS, OCCUPATION.

is impossible to enumerate all the causes of this condition, but are some points which should be considered. One must gnise that there is an idiosyncrasy to certain irritants, *cf.* poison phenylhydrazin, satinwood, etc. Ill-health has an important ing, as many cases have occurred in which a worker, at the trade for years, has become subject to occupation dermatitis an illness.

om statistics we find that individuals who have a seborrhœic or suffer from hyperidrosis, xeroderma or other skin eruption, nore susceptible to the effects of irritants. As prophylaxis is e utmost importance in this connection, and as workmen's com-ation has come so rapidly to the front, it will logically follow in future years the elimination of the unfit who have abnormal seased skins will have to be enforced in the selection of appli- for posts where the work involves irritation. Thorough ilation of the workrooms, frequent ablutions, and the use of ritating neutralising agents are common-sense rules to be ted.

ot liquids, benzene derivatives, soaps and alkalies act by ving the fat from the skin and causing hyperidrosis, which gs the irritants into more close contact with the skin. For class of case the use of lubricants, such as lard, lanolin or oil, during or immediately after work is of great advantage. n the eruption has broken out, the treatment is then that of na in its various stages. A severe dermatitis necessitates tion from work, and recurrent attacks justify insistence on ge of occupation.

e error that is too frequently made is in allowing the patient turn to work before the parts have returned to their normal , and, indeed, it is too often the patient who takes the law into wn hands.

r is useful in the later stage to restore tone to the blood-ls and remove thickening. X-rays also often act satisfac-rily in producing a slight increase in the horny layer and cing the tendency to hyperidrosis when applied in the later s, and in the earlier phases they also have an anti-phlogistic n. They should be applied for ten minutes four or five times during the course of a fortnight, a tube of about 4-in. spark-gap being used.

Houseworkers' or Charwomen's Dermatitis is very common, and recently my best results have been obtained by cleansing the parts with wool and spirit and then painting on crude tar (*see* Eczema). If this does not succeed, I then resort to zinc paste or lead and vaseline.

Tar Workers suffer from acne, which is liable to go on to epithelioma. Cessation from work and the application of soothing ointments is sufficient in the early stage, but if there is a definite ulcer it should be scraped with a sharp spoon and then rubbed over with the chromic acid bead.

In Miners one often sees a pustular eruption about the thighs, due to the trousers becoming soaked with foul pit water; this often yields to the injection of staphylococcic vaccines in addition to the use of a mild antiseptic ointment locally.

X-ray Dermatitis consists simply of an erythema which disappears rapidly under the use of a soothing lotion. If ulceration has been produced this may take months to heal, and is best treated first with starch poultices and then with bismuth subnitrate (10 gr. in 1 oz. of cold cream). It has been suggested recently to cut the cutaneous nerves before they reach the ulcer, and it is stated that this relieves the pain and hastens healing.

Many Plants produce an acute dermatitis, starting on the hands and face of individuals exposed to them. This generally subsides after the irritants have been removed or the patient removed from the plants. *Primula obconica, Rhus toxicodendron* and *Humea elegans* are the most common offenders in this country. White, of Boston, considers Lotia Nigra as almost a specific in *Rhus* poisoning.

Other forms of dermatitis arising in the course of work must be managed on lines indicated by the cause and the character of the eruption.

F. GARDINER.

DRUG ERUPTIONS.

AMONG the more common drugs which sometimes produce eruptions may be mentioned copaiba, iodides, bromides, antipyrin, quinine, belladonna, arsenic, salicylates and morphia. While there is no doubt about the question of idiosyncrasy, yet one most frequently finds that cases occur amongst the debilitated, and especially those who suffer from heart and kidney trouble.

Stopping the offending drug and the administration of light or milk diet, together with the use of laxatives, are in most individuals sufficient. Locally to follow the lines laid down by Stelwagon, the lesions should be treated according to the skin disease they most resemble.

To particularise, the hyperkeratosis of the hands and feet seen in cases subjected to long courses of arsenic is very intractable and is treated as a tylosis. Iodides should be given with plenty of water, and, as also in the case of bromide rashes, intestinal disinfectants are said to be beneficial.

F. GARDINER.

ECZEMA.

While there is no specific for eczema, one may lay down some rules which are probably of more value than a list of prescriptions. The protean character of the disease points to the stage of the eruption as being most important. Crusts are to be removed, otherwise most applications are useless, and this can be done by boracic starch poultices (*see* Cheiropompholyx) or olive-oil soaks, if removal by scrubbing is too painful a process.

Secondary infection is another matter which often requires attention before proceeding to attack the eczema itself. The trouble may spread rapidly over the body because of this infection from staphylococci, and it is necessary to stop the spread at once.

I may be pardoned for quoting Veiel's[1] dicta: First, "The more acute the inflammation, the milder the remedies that should be used"; second, "great precautions must be taken in the use of strong measures, and one should experiment with small doses on limited areas"; third, "persevere in treatment till the last traces have vanished, otherwise recurrences will occur."

The question of **diet** is not now generally held to be of so much importance in eczema, but it is a factor that every now and then has to be taken into consideration. Any item in the economy which affects the general tone of the body will interfere with the repair of diseased skin, so that patients should only be given food which they can assimilate without difficulty. In acute, widely spread types and in chronic cases in old people a vegetarian diet and abstinence from acid fruits is, I think, beneficial.

Bulkley,[2] in a recent discussion at the British Medical Association, instanced cases in which a diet of rice, bread, butter and water was credited with the resultant recovery. He advises that the rice should be thoroughly cooked into a flaky state with little water (never milk), and eaten slowly with butter and salt. Water should be taken apart from this, and the milk should be drunk warm, pure and alone, one hour before eating. Tea and meat were also condemned as xanthin-producing bodies.

Alcohol is contra-indicated in all cases, because of its action as a vaso-dilator.

Internal medicines must also be considered on the lines of building up the patient's system. Cathartics are regularly used by some authorities in acute cases. The skin is an excretory organ, and, as in the case of diet, one may lighten its labours by this means.

Arsenic was formerly considered as almost a panacea, but now is discredited except in very chronic cases, and even for these Veiel says it is useless, and this tallies with the writer's experience. Antimony has been highly praised by Jamieson[3] and others, but its value, if any, is more noticeable in the widespread cases. In a type of eruption showing bilateral symmetry and probably of nervous origin I have found quinine serviceable.

Rest in bed is what many patients dread; but in extensive disease and severe or stubborn affections of the lower limbs it must be insisted on, and when this is done the reward is ample. Regularity of temperature, freedom from irritation and facility in the application of remedies are *desiderata* best obtained by this means.

Local Treatment.—Most sufferers are generally impressed with the importance of avoiding even the daily wash, but in many cases this is a mistake.

While recognising the fact that occasionally one finds a skin so sensitive or so acutely inflamed that water produces irritation, yet in most cases it is much better to wash off dirty discharges and crusts than to allow them to remain. If a little starch is added to the water, then the specific gravity is almost that of blood serum; less exudation of serum occurs and therefore less irritation.

Soaps are practically uniformly alkaline and so harmful that in acute cases they must be avoided.

In an ordinary acute eruption one removes the crusts by any of the means mentioned at the beginning of this article, and then if the condition is not too extensive, applies a paste containing: ℞. Hydrarg. Ammoniat., gr. 5; Zinci Oxidi, Pulv. Amyli, Adipis Lanæ Hydrosi et Paraffini Mollis Albi, āā ʒij, on strips of linen, giving directions that this is to be changed twice or thrice daily, carefully removing the old ointment by wool and oil before the fresh material is put on. In a day or two the hydrarg. ammoniat. can be left out of the above paste as the secondary infection will have subsided, and after a few days of the plain zinc paste one may add to it salicylic acid (10 gr. to 1 oz. of paste). Sometimes if the lesions are very moist one employs silver nitrate (15 gr. to 1 oz. of water), painted on every second or third day. In very widespread attacks one may use the above method over the limbs where it is generally worse, and order either of the following lotions to be painted frequently on other parts: ℞. Acidi Borici, ʒj; Zinci Oxidi, Calaminæ Præparatæ, āā ℥ss; Glycerini, ʒj; Liquorem

Calcis, ad ℥vj; or ℞. Liq. Carbonis Detergens, Liq. Plumbi Subacetatis, āā ʒij; Zinci Oxidi, Glycerini, āā ℥ss; Aquam, ad ℥vj.

The latter is the stronger, and is of more value in the moister and seborrhœic cases. Economic considerations come in here, as ointments are much more expensive than lotions, and to poorer patients this is naturally of great importance.

At this stage also Hebra's lead plaster and vaseline (equal parts) are often of service.

There are probably now only some thickening of the skin and redness left if the above methods have been carried out for a long enough time, and at this stage tar is indicated. Zinc paste or vaseline, with 1 drachm of liq. carbonis detergens to each ounce, or a cleaner preparation, ℞. Picis Carbonis, 10 parts; Benzol, 20 parts; Acetone, 70 parts, are worth trying. The ointment should be rubbed in twice daily and the paint once daily or every second day at first; the tar can, of course, be made weaker or stronger as indicated, and in all cases the effects are to be carefully watched.

Redness and thickness must be entirely removed before the case is left.

Much attention has been given lately in France and this country to coal tar, and all are agreed that it should be thick, and therefore containing less of the more irritant leucol, and that it is best obtained direct from the gas works. Brisson[4] uses it thus, or with an equal weight of casein in a varnish, or as a powder containing equal parts of tar and powdered coke. Even in the most acute cases Brocq[3] employs the crude preparation, but as I can say from experience the technique must be careful. The surface is to be cleaned with fomentations, etc., even ether or soap and water may be employed, and then a thick layer of the tar is swabbed on, allowed to dry for not less than twenty minutes, and then dusted with powdered talc and bandaged with linen. If the parts are not very moist, this may be left on for forty-eight hours, but if moist it is best removed earlier; removal is carried out by means of oil. Should the part now seem irritated it is to be dressed with zinc ichthyol paste, and the tar re-applied two or three days later. In drier types the tar may be left on for two days and then dusted daily till it all desquamates off, which process occurs on about the fourth or sixth day. Several repetitions of this proceeding are generally necessary.

In *extensive types* where either of the above lotions or pastes do not suit, Whitfield's[5] prescription may be tried; he advises that the skin be kept continually moist by means of a wick or other method: ℞. Liq. Plumbi Subacetatis, ʒjss; Spirit. Vini Rect., ℥j; Aq. Destill., ad ℥viij.

His suggestion that in very purulent cases injections of mixed staphylococcus vaccines should be employed is worthy of mention. These are given once in two or three weeks in doses of 50 millions.

Itching is often troublesome, and if the other plans do not relieve it, the addition of camphor may be effectual. Jackson[6] recommends the following: ℞ Camphoræ, ʒss; Zinci Oxidi, ʒij; Pulv. Amyli, ʒiv.

Chronic patches are managed on the lines of treatment of the later stages as mentioned above. The salicylic acid may be increased gradually to 20 per cent., in which event it must only be rubbed in, as the use of spreads is then too painful; another plan is to apply it by means of 3 to 10 per cent. plasters.

For chronic cases it is hard to beat Hebra's old plan of scrubbing for a few minutes with liq. potass., waiting for about ten minutes till the serum exudes, washing off with water and then applying zinc paste. This process is very satisfactory in thick, dry patches, but has to be repeated.

Oil of cade is less odoriferous than tar, and is often useful. Lenigallol as recommended by Kromayer[7] may supply a desire for a cleaner preparation; it is made up in zinc paste, the strength being 10 per cent. Tumenol is praised by Veiel[1] in conditions where tar is not suitable: ℞. Tumenol, 1 to 3; Zincum Oxidum, Talcum, Glycerinum, Aquam Destillatam, āā, ad 100. This is to be painted on twice daily.

Oxidised pyrogallic acid or chrysarobin (3 to 10 per cent. in ointment for patches of lichenification) have their votaries, and may be tried.

Lastly, in very stubborn cases it is right to try the effects of X-rays. I can bear out the reports of successes recently recorded by Schamberg and Stelwagen.[8]

Infantile Eczema, when fully developed and affecting the whole body, often baffles all remedies. On the realisation of this depends the hope of success in the future. Hall[9] has investigated the condition very thoroughly, and classes it as an occupation dermatitis due to faulty or rather filthy treatment of what is a naturally sensitive skin. Vaccination, feeding and teething have little to do with the occurrence. The infant must be protected from irritant soaps and towels and guarded against changes of temperature, as well as being kept clean. On the appearance of the slightest eruption, which generally occurs on the face, a zinc paste should be applied. Whitfield sets a high value on equal parts of lotio nigra and lime water in fully developed cases.

The last traces may often be got rid of by the application of a 1 per cent. resorcin or 2 per cent. sulphur ointment.

Behind the ears eczema of a seborrhœic origin is often recalcitrant, and I have found a 2½ per cent. sulphur paste most useful. If this is not successful, then dusting with a powder of 10 per cent. boric acid in talc is recommended, to be followed by zinc ichthyol salve muslin.

The above method may be used for all the intertriginous eczemata, but if they are very moist one may use the silver nitrate solution or nargol (2 to 5 per cent. in paste).

The hands in the acute stages are treated very much as is cheiropompholyx, but a common condition is fissured eczema with the accompaniment of thickening of the horny layers, which must be attacked by a keratolytic, such as the salicylic acid, and this has often to be used in 10 to 20 per cent. strengths. Plasters spread in these strengths are a ready method of application.

F. GARDINER.

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EPIDERMOLYSIS BULLOSA.

No treatment is of much avail in this condition, which is generally hereditary. The patient must be protected as much as possible from any external irritants, and for that purpose should wear very smooth underclothing.

Ichthyol or lactate of calcium may be tried as a means of alleviating the inconveniences of the disease.

F. GARDINER.

EPITHELIOMA AND OTHER MALIGNANT GROWTHS OF THE SKIN.

Early and free removal is the safest treatment, although recurrences may usually be looked for when the disease occurs on the flat surfaces. This is not so, however, in the case of epithelioma of the lip, where a wedge-shaped piece of tissue can be removed involving the whole thickness of the lip; here the prognosis is much more favourable. Radium may give good results in the early stages, although operation would be better; it should be used when operation is refused, or when the case is inoperable. It is applied in the same manner as in rodent ulcer, but does not give such good results. When dealing with a raised mass, which can be attacked on several sides as well as from its top surface, the outlook is better; this method is known as "feu croisé," and sometimes gives a rapid and permanent cure.

Free cauterisation with the actual cautery is also a fairly satisfactory treatment, but the operator must go well into the surrounding healthy tissues.

The X-rays are useful in the flat, diffuse type; otherwise they can only be looked upon as palliative.

Chemical caustics are painful and unreliable; arsenic and potash are perhaps the best.

Hutchinson's crateriform ulcer should be looked upon as an epithelioma, and excised freely as soon as possible.

Melanotic growths are usually carcinomatous, especially if arising from a pigmented mole, rarely sarcomatous; moles should be excised as soon as there is any sign of increase in size or pigmentation, or if there is any bleeding or ulceration, and the tissue should be examined microscopically.

Sarcoma Cutis.—The only treatment is early and free removal of the growth. In sarcoma of the skin, however, the growths often appear in large numbers at once, so that excision of them all is impossible. Treatment by X-rays is disappointing; it occasionally causes the disappearance of some of the growths, but never gives a permanent and complete result. Radium may do good in isolated individual nodules, but does not cure the disease. Arsenic has been given both by injection and in the usual manner by the mouth, but the results are not very encouraging. "Kaposi's pigmented sarcoma" is generally looked upon now as being of an inflammatory nature, and not a sarcoma.

The term "sarcoid" has been applied to benign nodular disease by Boeck; it is not a sarcoma, and will be mentioned under Tuberculosis Cutis.

WILFRID S. FOX.

ERYTHEMA MULTIFORME.

Although this eruption may be produced by many toxins, yet one finds that the great majority of the cases are of rheumatic origin, intestinal toxæmia standing next in order of frequency. Given an ordinary type it is a good rule to administer a laxative, and follow with 10 gr. of acetyl-salicylic acid four hourly. If this fails, then some intestinal antiseptic, such as salol or beta-naphthol, should be prescribed, the patient at the same time being put on a milk diet.

It is the occasional stubborn case that puzzles, and then careful inquiry must be made for a history of drugs or toxic foods being taken, and if this is found, their effects must be eliminated.

Among internal remedies, which have been empirically found useful in the more obscure types, may be mentioned in order of importance calomel, ichthyol, antipyrin, calcium salts and iodide of potash. Erythema iris yields often to quinine when other remedies fail.

Gilchrist,[1] acting on the assumption that some erythemas (he mentions more particularly the bullous type) are due to the toxins of staphylococcus albus, has given vaccines of this germ in doses of 300 to 500 millions every seven days, and reports success.

Locally little is generally required, but if there is much irritation then a boro-calamine lotion, or this with the addition of 2 per cent. of ichthyol or carbolic acid, may be painted on frequently.

In *bullous or impetiginous cases* the following paste may be supplied on spreads: ℞ Hydrarg. Ammoniat., gr. 5, vel. Ichthyol., gr. 20; Pulv. Amyli, Zinci Oxidi, Adipis Lanæ Hydrosi, Paraffini Mollis Albi, āā ℥ij.

Recurrences are common if the regulation of the diet is not attended to and rheumatism is not thoroughly treated.

F. GARDINER.

Reference.

[1] American Journ. of Cutan. Dis., 1909, p. 336.

ERYTHRASMA.

This disease, which as a rule is easily cured in the individual, may, when it occurs as an epidemic in a hospital or large institution, particularly amongst phthisical patients, be somewhat difficult to completely eradicate, cases frequently cropping up after considerable intervals, a fact which makes the method of contagion very difficult to trace.

Locally the affected part should be washed well with soft soap and warm water, or better with soap spirit lotion (soft soap and rectified spirit, equal parts), and then painted with a strong iodine solution, either in the form of plain tincture of iodine or, when the skin will stand it, a drachm of glacial acetic acid to the ounce of tincture of iodine. If the skin gets very sore with this treatment, a mild sulphur and salicylic acid ointment (Sulphuris Præcipitati, gr. 15; Acidi Salicylici, gr. 10; Adipem Benzoatum, ad ℥j) should be rubbed in. In many cases this ointment is sufficient to produce a cure without using the more heroic tincture of iodine. When the disease occurs in institutions, the affected individuals should be isolated and all bed utensils and articles in common use should be thoroughly disinfected.

WILFRID S. FOX.

FAVUS.

THE treatment of this condition is in nearly all respects similar to that of ringworm, but it should be remembered that the result of X-ray treatment does not in the end give such satisfactory results as with ringworm because a certain amount of scarring is produced by the disease itself; it is, however, the most satisfactory method of dealing with the disease.

When X-rays are not available, depilation of the stumps with forceps can be carried out more satisfactorily than is the case with ringworm, as the stumps are not so brittle, and if care is used they can generally be extracted whole. When crusts are present, these must be removed by shampooing with soft soap and spirit lotion, equal parts, and by the application of olive oil fomentations before the X-rays are used. The same parasiticides may be employed as in ringworm, that is to say, when X-rays are used, the weak sulphur and salicylic acid ointment and weak iodine solution, or where depilation is done, strong iodine, oleate of copper or chrysarobin ointment. In the early stages strong peroxide of hydrogen (15 or 20 vols.) will also be found a very satisfactory disinfectant of the scalp.

Favus of the smooth skin is also treated on the same lines as ringworm after removal of the crusts. When the nails are affected, it is advisable, even more so than in ringworm, to remove the nails completely at the very beginning, in order to allow the parasiticide to penetrate.

WILFRID S. FOX.

GRANULOSIS RUBRA NASI.

The name "granulosis rubra nasi" was applied by Jadassohn to a peculiar affection of the nose in children, characterised by persistent sweating of the skin of the cartilaginous portion, associated with diffuse redness and the presence of inflammatory micropapules at the sweat orifices. The etiology and pathogenesis are uncertain, but the condition usually occurs in weakly, delicate or scrofulous children with a feeble peripheral circulation and the subject of chilblains, congested extremities and hyperidrosis of the palms and soles. The ultimate prognosis is excellent, as in the majority of cases the affection seems to disappear spontaneously about puberty. The immediate prognosis is unfavourable, however, as it is singularly resistant to treatment.

The **general treatment** to be adopted has the object of improving the tone of the patient, or counteracting some obvious defect in health by suitable general measures, such as cod-liver oil, iron tonics, fresh air, good food and the like.

With regard to **local treatment**, a large variety of applications have been tried, but as a rule with only temporary benefit. Painting with tincture of belladonna was employed daily for a month by the writer without any marked effect on the hyperidrosis, and the best results were obtained by the application of a sponge wrung out of very hot water, followed by an astringent dusting-powder such as equal parts of zinc oxide, starch and tannic acid, and the employment of a zinc paste at night. By this means temporary benefit can be obtained so long as the treatment is continued, but a relapse usually follows its intermission. Repeated quadrillate scarification has been suggested for it, and is said to give satisfactory results by causing superficial scarring; but this treatment should be deprecated for fear of producing disfigurement in a condition which ultimately disappears spontaneously.

J. M. H. MACLEOD.

HERPES FEBRILIS.

On the face the use of cold cream and washing with alcohol or eau de Cologne is the best treatment for the lesions. This will not, however, prevent recurrences, which necessitate a careful overhauling of the patient's system and correction when found faulty. Particularly one should inquire into sources of nerve irritation, such as decayed teeth, enlarged tonsils, or affections of the eyes. Walker[1] states that if in each attack the affected region is painted with a solution of 20 gr. of silver nitrate in 1 oz. of spiritus etheris nitrosi a cure may result.

On the genitalia bathing with boracic lotion and the use of a dusting-powder of 10 per cent. of boracic acid in talc is most beneficial. Freedom from irritation locally must be inculcated. Circumcision in the male is sometimes advised in obstinate cases.

F. GARDINER.

Reference.

[1] "Introduction to Dermatology," 5th ed., 1911.

HERPES ZOSTER.

If this disease is seen in the **premonitory stage**, the mistake that is to be avoided is the ordering of some liniment or cataplasm for the pain which precedes the eruption.

If seen **when the eruption is just appearing**, I believe that a dose or two of high-frequency treatment locally by the effleuve and generally by means of the couch, acts as an abortive agent. Left to itself the condition gets well in time, and what one wants to avoid is sepsis and resultant severe scarring.

Before pustulation has set in painting with collodion yields good results, or perhaps still better is zinc-ichthyol jelly.

Another method which does very well is simple dusting-powder with the super-position of wool and a bandage.

When pustulation has occurred, one should employ a weak mercurial ointment (5 or 10 gr. of hydrarg. ammoniat. in 1 oz. of vaseline) on linen spreads. One of the most serious types is that in which the eye is affected, and then most careful precautions have to be taken to avoid panophthalmitis. Bathing with boracic or ½ per cent. protargol lotion and the use of the above ointment is a good plan in such an attack.

For the subsequent pain, which is most severe in elderly people, the use of analgesics, such as phenacetin, is often required, but sometimes it is only removed by injections of morphia. Much better, in my estimation, than these drugs is the use of the ethyl chloride spray. Various areas of the skin over the root ganglia and the cutaneous branches may be frozen by this plan on successive days with relief to the patient.

All forms of electricity and the internal administration of drugs, such as quinine, arsenic and strychnine, are recommended, but I have never seen them do much good.

F. GARDINER.

HYDRADENOMATA, OR ADENOMA OF THE SWEAT GLANDS.

(*Synonyms.*—Benign Cystic Epithelioma; Endothelioma Tuberosum Multiplex; Syringadenoma; Lymphangioma Tuberosum Multiplex.)

The treatment of these small tumours is either excision or destruction with a fine electro-cautery, or electrolysis.

WILFRID S. FOX.

HYPERIDROSIS OR EXCESSIVE SWEATING.

THIS affection may be general or local. It occurs most frequently about the hands, feet, axillæ and genito-crural region, and is liable to be associated with decomposition of the sweat and the presence of an offensive odour (Bromidrosis).

The treatment of generalised hyperidrosis should be on general medical principles, and too much reliance should not be placed on such specific remedies as atropine, belladonna, and salicylate of soda, as their effect is temporary. The affection being usually associated, unless when it is simply the result of violent exercises, with defective general health, every means, dietetic, hygienic, and medicinal, should be resorted to, to improve the general condition, and the well-known tonic remedies such as iron, quinine, and strychnine should be employed. Alcohol and tobacco should be strictly limited or forbidden.

The local treatment consists in drying the skin and the free application of a dusting-powder containing magnesium carbonate, bismuth or zinc oxide, with the addition of 2 or 3 per cent. of salicylic acid. Astringent lotions containing 2 per cent. of alum or tannic acid may be sponged over the skin with advantage, or whole baths containing salt water or half an ounce of alum to the fifteen gallons of water employed. Whole baths should be used with caution, however, in delicate skins, as they are apt to cause dermatitis.

When the axillæ or the genito-crural region are involved, the skin should be kept scrupulously clean, rubbed twice a day with alcohol, to which 1 per cent. of quinine has been added, or with eau de Cologne, and the salicylic dusting-powder applied. Great attention should be paid to the clothes which are in contact with the moist skin, as the sweat is absorbed by them and the offensive odour clings to them. Dress preservers should be worn by women to avoid soiling the dress, and the underclothing should be changed frequently. In very intractable cases resort may be had to the X-rays, and great benefit may be derived from one or two pastille doses at intervals of a month or six weeks. When the feet are affected they should be bathed twice daily in boric lotion, rubbed over with alcohol, and a dusting-powder containing salicylic acid 2 per cent., or tannoform 1 part to talc 2 parts should be subsequently applied. The socks should be white, as dyed socks are acted on by the alkaline sweat, and the dye is freed and stains the skin. They should be changed twice a day, and the salicylic powder dusted into them before they are put on. When the sweat is markedly offensive, the feet should be bathed in a 5 per cent. solution of formalin, or in a 1 per cent. solution of permanganate of potash. It is inadvisable to wash the affected feet with soap and water, as it has a macerating action on the skin and is apt to make them more tender. When there is much inflammation and the skin is raw in places or septic, the following ointment should be applied after cleansing with boric lotion: Salicylic Acid, gr. 10; Alum, gr. 10; Zinc Oxide, ʒiij; Vaseline, ℥j.

If the feet are painful, considerable relief may be derived from diachylon ointment spread on butter muslin and applied under a bandage, the toes being dressed separately, and in the most severe cases it may be advisable for the patient to lie up for a few days.

Shoes should be worn instead of boots, as they are cooler, and they should have soft leather uppers and medium thick soles. To prevent their becoming offensive, they may be sprinkled inside with formalin solution before they are put on.

J. M. H. MACLEOD.

HYPERTRICHOSIS.

Hypertrichosis, or excessive hair-growth, is common in both sexes, and may occur on various parts of the body, such as the chest, arms and legs, but it is when it is present on the face in women that the physician is usually consulted with regard to the removal of the hairs. There it not only forms a disfigurement, but has a more or less disastrous mental effect in women, rendering them over-sensitive, making them shun their fellows, and occasionally causing them to think so much about their trouble that it becomes almost an obsession. In women under twenty-five it may occur simply as a fine growth of downy hairs about the upper lip, chin and cheeks; if they are fair the disfigurement produced by this is comparatively slight; on the other hand, in brunettes even fine downy dark hair, especially about the upper lip, becomes noticeable. After the age of twenty-five there is a tendency for those downy hairs to become transformed into long thick hairs like those of the beard in men, and this transformation may gradually progress until a strong beard and moustache result. In a certain number of cases, also in women about the menopause, a few isolated large hairs may appear about the sides of the chin. In men superfluous hairs occasionally occur on the bridge of the nose, on the lobe of the ear, or between the eyebrows on the forehead. The physician may also be consulted with regard to the removal of groups of hairs occurring in association with birth marks situated about the face.

In the case of the small downy hairs in young women under twenty-five, when the disfigurement is not marked the patient should be advised to have nothing done. The application of a dusting-powder at night, containing equal parts of starch and zinc oxide, has a drying influence and may retard the growth. In brunettes the slight disfigurement from the pigmentation of the hairs may be reduced by bleaching them with hydrogen peroxide (10 vols.). At the same time patients should be strongly advised not to attempt any measures for the removal of the growth on their own account, such as epilation, clipping with scissors or depilatories, for these only make matters worse by stimulating the growth and transforming the lanugo hairs into long hairs. Should a certain number of long hairs be present in the midst of the fine downy hairs it is obvious that the "hair change" is taking place, and it is advisable to intervene and attempt the radical removal of the growth. In older patients where long hairs are present, whether they are few or numerous, forming a moustache or beard, their removal is usually demanded by the patient.

The only satisfactory method for the removal of superfluous hairs at present at our disposal is by electrolysis.

Recently the **X-rays** have been employed for this purpose, but their use is to be strongly deprecated, because although they are a most valuable means for producing a temporary defluvium, any attempt to cause a permanent epilation by them is almost certain to be followed by disastrous results. A Sabouraud pastille dose is the maximum dose which may be given to the skin without producing dermatitis; this causes the hair to fall out, but re-growth takes place in a few months. If the maximum dose is exceeded a permanent defluvium may result, but it will only do so when atrophic changes have taken place in the skin, which may be followed later by disfiguring telangiectases or a definite X-ray dermatitis. Attempts have been made to prevent this by interposing between the skin and the tube a screen of aluminium, about ½ millimètre in thickness, to cut off the less penetrating rays which it is asserted are responsible for the dermatitis, and by giving a series of screened pastille doses at intervals of about a fortnight. It is said that in this way the papilla and the deeper part of the follicle may be permanently destroyed without injuring the skin. This, however, is a matter regarding which there is no certainty, and the procedure even in the hands of an expert is attended with considerable risk, and until the theory on which it is based has been definitely proved to be correct, namely, that the rays which produce the superficial dermatitis are weakly penetrating rays which can be cut off by the aluminium screens, it should not be undertaken.

Depilatories are also unsatisfactory and are liable to do considerably more harm than good. Of these the most frequently employed contain sulphide of barium, as in the following formula: Barium Sulphide, ʒj; Starch, ʒiij; Zinc Oxide, ʒiij: this is mixed into a paste with a little water, rubbed on the skin for five minutes, then removed and a bland zinc paste applied. Or, Barium Sulphide, gr. 10; Starch, gr. 15; Benzaldehyde, ad ʒj; Powdered Soap, gr. 15: this is applied for five minutes, then washed off.

Such depilatories simply corrode the hair as far as its exit from the follicle, and have practically no action on the intra-follicular growing portion except in irritating it to further growth, and at the same time they inflame the skin and may even cause eczematisation.

Epilation should also be strongly deprecated, as it invariably strengthens the hair-growth and transforms fine downy hairs into coarser hairs.

Of the temporary measures of dealing with hypertrichosis of the face in women, where the growth is so excessive and the circumstances of the patient are such as to render electrolysis out of the question, the most satisfactory method is *shaving*. This procedure is repugnant to most women at first, but the initial prejudice is gradually overcome by custom and by the employment of a safety razor.

Electrolysis. — As already stated, electrolysis is the only radical method of destroying hairs at present known. If properly done, it is practically painless and should leave little or no scarring. It is, however, an operation of exceeding delicacy, and is tiring to the operator. To perform it satisfactorily requires both knowledge and skill. If it is inferiorly done, it is valueless, and may be responsible for disfiguring cicatrices and even for keloidal scars.

The requisite apparatus consists of a galvanic battery of at least ten cells fitted with a reliable milliamperemeter, a cylindrical electrode covered with chamois leather, and an electrolysis needle-holder. Every operator has his own favourite needle-holder, of which there are a number of patterns. The one which I prefer is light and about 3 inches long. To one end of it is attached a thin connection cord, about 2 yards in length, which is soldered to the end of the holder, and not fixed in the usual fashion by a screw. The needle itself is fine and tapering, bent at an angle of 45 degrees about ½ inch from the point, and made of platino-iridium. The advantages of this over a fine steel sewing needle (No. 16) are that it can be bent, is slightly blunt, and consequently is less liable to pierce the follicular wall in catheterising the follicle, and it can be heated to red heat in the flame and so sterilised. The holder and connection cord being so light do not impair the sense of touch, and facilitate the delicate manipulation on which the success of the operation depends. A small pair of forceps about 1½ inches long are fixed to the holder for removing the electrolysed hairs. The holder may be fitted with an attachment for making and breaking the current, but this is unnecessary, as the patient can do this by grasping or letting go the electrode. To certain of the holders a small lens is fixed, but this is of little value, and only makes the holder unnecessarily heavy. In order to see the follicular opening it is advisable, however, for the operator to use a lens of some kind. The ordinary watchmaker's lens has the great disadvantage of a short focal distance, and necessitates an uncomfortable proximity to the patient. An ordinary pair of spectacles with a single lens of about 10 dioptres, or a binocular magnifier, such as that devised by Treacher Collins, enables the operator to work comfortably at a distance of about 5 inches from the patient.

The patient should be seated opposite a good light in a comfortable chair, the head steadied by a head-rest or cushion, and a towel placed on his lap. The cylindrical electrode attached to the positive pole of the battery is dipped in a solution of salt and water and grasped by the patient, while the needle-holder is connected with the negative pole. The operator then steadies the patient's head in a comfortable position, and having selected the hair to be electrolysed, inserts the point of the needle into the orifice of the follicle on the obtuse angle side of the hair; the needle is then gently pressed down parallel with the long axis of the hair for about $\frac{1}{8}$ inch till the whole length of the follicle has been catheterised. The controlling handle of the battery is then turned on till 2 to 5 milliampères are registered on the meter. The needle should then be pushed down for another $\frac{1}{16}$ inch so as to pierce the hair papilla, and allowed to remain in the follicle for about ten seconds, when a frothy bead of hydrogen may be seen at the mouth of the follicle, showing that the electrolysis is taking place. The current is then gradually reduced and the needle withdrawn. The most difficult part of the procedure is the proper insertion of the needle and the passing of it through the papilla; since the follicles usually slant in an oblique direction, it is easier to penetrate the follicular wall and pass the needle alongside the papilla than through it.

The next important point is the method of making and breaking the current. The ideal procedure is for the battery to be worked by an attendant, who should be told to turn on the current gradually to the requisite strength after the needle has been inserted, and after a given number of seconds to reduce it to *nil*, when the needle is withdrawn. About a minute later the hair should be found to be loose in the follicle and easily epilated, coming away with a swollen gelatinous sheath. When one has to do the operation without assistance, the patient may be asked to make and break the current by grasping and letting go of the electrode, or a needle-holder fitted with an attachment for this purpose which is controlled by the operator may be used. On no account should the needle be inserted charged with electricity, as it not only produces a certain amount of electric shock, but owing to its corroding effect passes too easily through the wall of the follicle, and it is almost impossible to tell if it is in its proper position. In the same way the needle should not be withdrawn until the current has been turned off, or an unnecessary shock will be produced. The hair should not be epilated immediately on withdrawing the needle, but a minute or more should be allowed to elapse, during which time a softening and loosening process takes place which enables the hair to be drawn out easily. To avoid wasting time in waiting, half a dozen hairs may be electrolysed one after another, these being pulled out in the order in which they were electrolysed, and another batch then being treated in the same way. The effect of the electrolysis is to produce a necrosis in the follicle, made evident by a yellowish stain surrounded by a pink zone at the orifice. Should the needle have been wrongly inserted and passed through the follicle into the corium, the pain is more acute and a blanching takes place. Soon after the electrolysis an urticarial lesion may appear around the follicular orifice and persist for a few hours, or a vesicular lesion be formed. These are gradually replaced by small scabbed lesions, the scales of which separate in a few days, leaving an erythematous macule, which in time disappears, and is followed by a white atrophic scar, which is generally so minute as to be scarcely noticeable. If the electrolysis has been excessive a small pit may be left, and sometimes a keloidal thickening. Great care should be exercised in performing the electrolysis to avoid attacking contiguous hairs, for by so doing the necrotic zones may overlap and a superficial ulcer be produced. Occasionally when the needle is withdrawn a small hæmorrhage may occur, but this is easily stopped by pressure with a piece of cotton-wool. In dark-skinned people the procedure is frequently followed by slight pigmentation, which disappears in a few months.

The requisite current varies according to the size of the hair to be destroyed. Where the hairs are fine a current of 1 to 2 milliampères may suffice; in the case of hairs of a medium size about 3 milliampères are necessary, while in strong coarse hairs 4 to 5 milliampères are advisable.

The time during which the current should pass varies from five seconds in the case of fine lanugo hairs to twenty seconds for coarse hairs, ten seconds being an average time. About forty long hairs or sixty lanugo hairs may be electrolysed at a sitting of half to three-quarters of an hour; more should not be done, as it not only becomes irritating to the patient, but is tiring for the operator.

The pain or discomfort associated with the operation varies greatly in different cases and in different situations in the same cases. It consists of a pricking pain when the current is made, and a burning sensation as the electrolysis of the follicle proceeds. It is, as a rule, most intense on the upper lip towards the middle line, near the lower eyelid, and on the lower lip, and is least painful on the sides of the chin and in the soft parts of the cheek. In any situation also spots occur where the pain is much more marked than in others. It varies greatly in different individuals, and is sometimes so marked in sensitive neurotic women as to make it impossible or inadvisable to electrolyse more than about twenty hairs at a sitting. Other sensory symptoms may be produced by the operation, such as a metallic or salt taste in the mouth or slight tingling about the teeth, but these are of little consequence. The pain cannot be satisfactorily removed by a local anæsthetic. Attempts have been made to do this by injections of cocaine, but the wide distribution of the affection, and the considerable dosage of cocaine which is necessary, renders it an unpractical and somewhat dangerous proceeding. Freezing with ethyl chloride has also been employed, but is unsatisfactory, as it hardens the tissue too much. In cases where only a tuft of large hairs has to be removed, the injection of about 1 cubic centimetre of 1 per cent. solution of novocaine deadens the pain, but is unnecessary.

After the operation the face should be thoroughly swabbed over with boric acid lotion, and the patient should be told to bathe it with boric acid lotion once or twice daily, and to apply to the inflamed areas calamine lotion or an antiseptic paste, such as the following: Hyd. Ammoniat., gr. 10; Zinc. Oxidi, ʒj; Paraffin. Moll. Alb., ad ℥j.

The **Prognosis** varies indefinitely with the type of case and the skill of the operator. With the utmost care and skill an operator may consider himself fortunate if he has been able to destroy 80 per cent. of the hairs electrolysed at a sitting. Owing to the ease with which the point of the needle may slip past the papilla, about 20 per cent. of the follicles are apt to be imperfectly electrolysed, and hairs will grow again in them in the course of a few months. It is advisable to inform the patient of this probability, and to arrange for a second course of sittings in three or four months' time. The cases which give the most satisfactory results are those in which only a few somewhat sparsely distributed long hairs occur about the chin in middle-aged women. In these cases the hairs can be satisfactorily destroyed; in a few partially electrolysed follicles hairs will grow again or new ones may appear, but an occasional treatment about once a year may suffice to keep the condition completely under. It is a different matter, however, in the cases where large numbers of long hairs are present, forming a beard, whiskers, or moustache, and situated in a forest of fine lanugo hairs which are gradually becoming transformed into long hairs. Brocq has estimated that there are from 1,000 to 9,000 hairs on the chin, 15,000 to 19,000 on the entire beard, and 500 to 1,200 on the upper lip. With this possibility in view, the difficulty of completely destroying such a growth is colossal. Much can be done, however, to minimise the disfigurement by courses of treatment at regular intervals of six months or a year. In the case of the upper lip, unless the hairs are strong and long, it is, as a rule, wiser to leave it alone ; the hairs are usually fine in that situation, and the follicles so small and tight that the process is extremely difficult and painful, and should it be imperfectly done may leave disfiguring scars.

J. M. H. MACLEOD.

ICTHYOSIS AND XERODERMA.

The term Icthyosis Hystrix has generally been used as synonymous with Verrucose Nævus, and the treatment will be found under that heading.

When the degree of icthyosis is severe, very little can be done to cure the condition. As the deformity is diffuse and affects the skin as a rule all over the body, strong measures, such as cautery, which has been suggested for localised patches, cannot be employed. All that can be done is to rub in a mild emollient cream to prevent the dry skin from cracking, and the formation of septic crusts. The following has been found to alleviate the symptoms: ℞. Acid. Salicyl., gr. 15; Zinci Oxidi, ʒv; Adipis Lanæ Hydros., ʒiij; Ol. Oliv., Liquor. Calcis, āā ʒj.

In the less severe cases, and especially those which are associated with eczema of the infantile type, it is always worth while to give thyroid extract internally. It is true that in some cases the effect is *nil*, but others are very greatly benefited by it. Externally, mild tar ointments give relief, such as ℞. Ung. Picis Liquid., ʒj; Zinci Oxidi, ʒss.; Paraffini Mollis, ʒij; Adipem Benzoatum, ad ℥j. In other cases glycerine is particularly useful, or salicylic acid 10 gr. to 1 oz. of glycerine: also resorcin 10 gr. to the ounce of glycerinum amyli. Some patients prefer simply plain lanoline, and in all cases the treatment has to be kept up continually in order to keep the skin lubricated, or the condition would revert at once to the original state.

In those mild cases of xeroderma which are chiefly seen on the extensor surfaces of the limbs during the winter months, it is always worth while trying the above local treatments, as the patient can be kept very much more comfortable through the winter months when the suitable application for the particular case has been found.

WILFRID S. FOX.

IMPETIGO.

General Remarks.—Under the heading of impetigo a certain number of different affections have been grouped, all of which are due to the inoculation on the skin of pyogenic micro-organisms, some being produced by the Streptococcus pyogenes, others by the Staphylococcus pyogenes aureus and albus, while others result from a mixed infection of both types of cocci. To the Streptococcic group belong impetigo contagiosa, impetigo gyrata, and impetigo bullosa. To the group resulting from staphylococci belong the cases of pustular folliculitis known as the impetigo of Bockhart, and to the group of the mixed coccic affections belong various forms of pustular dermatitis, such as occur in association with septic inoculations of the skin, whitlows, abscesses, and parasitic diseases, such as pediculosis and scabies. The common affection which occurs in boys' schools, and is popularly known as "scrum-pox," is either a streptococcus impetigo or a mixed infection. As a variety of impetigo bullosa may be included the affection, which was once so common in lying-in institutions, but is now fortunately rare, known as "pemphigus neonatorum," and as a variant of impetigo contagiosa the superficial ulcerated condition which occurs in weakly cachetic patients known as "ecthyma."

The treatment of all these affections is satisfactory, and in the majority of cases a cure can be effected in a few weeks, the lesions, as a rule, being superficial and leaving no scarring when healed. The treatment varies in different cases according to the extent of the disease and the resistance of the individual. It consists in the main of local measures, which should be actively carried out, since the condition is not only auto-inoculable but markedly contagious. The affection, however, frequently occurs in children of the hospital class whose state of nourishment is below par, and who may be the subjects of definite debilitating diseases; in such cases tonic treatment on general medical lines is indicated. In every case the state of the general health of the individual affected should be considered and treated, if necessary.

Local Treatment.—In the case of ordinary *impetigo contagiosa* in which the face, scalp or other parts of the body are more or less plastered over with the typical amber scabs, the treatment is comparatively simple. It consists in the first instance in the removal of the scabs. This may be done on the face by hot water and soap, or by warm boric acid lotion applied on lint. On the scalp it is more difficult to get rid of the crusts, and they may have to be softened with olive oil under guttapercha tissue or by a boric acid and starch poultice before they can be removed. The poultice should contain a teaspoonful of boric acid to a teaspoonful of cold water and starch added to ½ pint of boiling water. This is spread on cotton, covered with muslin, and applied to the scalp for an hour or more. After it is taken off the scalp is washed with soap and water, and any pieces of scab which are still adherent can be removed by a blunt, flat instrument such as a paper knife. The removal of the crusts may be greatly facilitated by cutting the hair short or by clipping the hairs beneath the scabs. After the scabs have been thoroughly removed a mild parasiticide ointment should be applied continuously such as the following: Hyd. Ammoniat., gr. 14; Paraffinum Molle Album., ad ℥j.

Should any scabs re-form they must be subsequently removed, but this should not take place if the ointment is continuously applied. In connection with impetigo the neighbouring lymphatic glands frequently become enlarged, especially the gland beneath the chin or those on the back of the neck when the occiput is affected. These gradually resolve as the affection is cured and necessitate no special treatment. The patient should be warned with regard to the contagiosity of the affection, and should on no account allow anyone else to use towels or brushes, etc., which he has been using. When the covered parts of the body have been involved, the underclothing should be thoroughly disinfected.

The *gyrate and bullous forms of impetigo* require to be treated on similar lines, but owing to the extent of the surface affected the application of mercurial ointment may be contra-indicated owing to the possibility of its being absorbed. As a substitute for the mercurial ointment 3 per cent. boric acid ointment in vaseline may be employed. In extensive cases daily boric acid baths containing about ½ per cent. of boric acid are of value, and should be followed by the application of boric acid powder to any moist lesion.

Especially active local treatment is demanded in cases of *impetigo bullosa in infants* of the type known as *pemphigus neonatorum*, to prevent the affection becoming generalised and a fatal septicæmia or pyæmia resulting. It is exceedingly important to recognise those cases and to realise that they are neither ordinary pemphigus or syphilis, but are the result of inoculation of streptococci, possibly by the midwife. Failure to recognise this may lead to serious consequences with regard to the infant, and to a further dissemination of the disease by the midwife being allowed to attend other cases of confinement while suffering from a virulent septic sore. In these cases the affected infant should be immersed several times daily in a warm boric acid bath, then dusted with boric acid, and any raw lesions dressed with boric acid ointment or dabbed with corrosive sublimate lotion (1 in 4,000).

The staphylococcus forms of impetigo when superficial require the same treatment as impetigo contagiosa. When the lesions are follicular, they are apt to spread deeply and become transformed into boils or furuncles, for the treatment of which *see* the article on Boils.

J. M. H. MACLEOD.

INNOCENT TUMOURS OF THE SKIN (MYOMATA).

Myomata of the skin may be either leiomyomata, fibromyomata, or angiomyomata. When these tumours are single, small in size, and pedunculated, there is very little difficulty in either excising them with a knife or snipping them off with a pair of scissors under a local anæsthetic. There is no fear of any recurrence after excision, and it is undoubtedly the most satisfactory method of dealing with them. In the case of very small myomata, negative electrolysis (*see* Nævi and Moles) may be used to destroy them.

WILFRID S. FOX.

KAPOSI'S DISEASE (XERODERMA PIGMENTOSUM).

This rare condition can only be treated in a palliative way, that is to say, it is impossible to cure the individual of his deficient resistance to ultra-violet light; one can only protect him from the effects. This should be done first of all by removing the patient from the tropics, or from any climate where there is an excess of strong sunshine, dull, cloudy, climatic conditions being the most suitable. Further, the skin should be protected either by veils, or, better, by application of pigments; these are preferably of the brown or reddish tinge, as that colour cuts out ultra-violet light more satisfactorily than any other. If this is done in the early stages of the disease, there is a very good chance of delaying its progress. After the warty growths have once formed it is useless, as a rule, to excise them.

Sabouraud advises the application of a 3 per cent. potassium chlorate ointment.

In the later stages the chief objects are to keep the ulcers and small tumours as clean as possible and to prevent inflammatory conditions of the eyes. This is best done by bathing the whole face several times a day with boracic acid lotion and dressing the ulcers with white precipitate ointment, diluted half B.P. strength. [U.S.P. unguentum hydrargyri ammoniati, half strength]. Destruction of the warty growths with the electro-cautery is sometimes satisfactory. There is no drug which has any effect on the disease by internal administration. Whether radium will have effect on the epithelial tumours has yet to be proved. When epithelioma supervenes the course is, as a rule, not very rapid, and the treatment will then be free excision, radium, or actual cautery.

WILFRID S. FOX.

LENTIGO (FRECKLES).

The general method of treatment is to produce a desquamation by the use of strong irritants; it should be remembered, however, that the freckles tend to reappear again after a longer or shorter interval, according to how much the patient is exposed to strong sunlight, the freckle being the effort on the part of nature to cut out the ultra-violet rays in people who are deficient in pigmentation.

The drug generally employed is carbolic acid (1 in 10), which is best applied on a pointed match to each freckle, and after a few minutes, the action is controlled by olive oil. A 1 in 500 solution of perchloride of mercury is also effective in producing desquamation, or a strong resorcin ointment made up as follows, Resorcin, Zinc Oxide, Vaseline—āā ʒij—may be applied at bedtime and removed in the morning, but the reaction is severe. Hydrogen peroxide (10 to 20 vols.) is sometimes of service in bleaching the freckles, especially if used in combination with strong salicylic acid cream (ʒss ad ℥j). Care should be taken not to irritate freckles and patches of pigment on the faces of old people, as these sometimes develop into rodent ulcers or melanotic growths (lentigo-melanosis).

WILFRID S. FOX.

LEPTOTHRIX.

The treatment of this affection of the hairs of the axillæ, in which the shaft becomes more or less surrounded by a concretion, is unsatisfactory. It is frequently associated with chromidrosis and the treatment for that condition is equally applicable (*see* Chromidrosis).

The hairs should be shaved and 1 per cent. solution of permanganate of potash or 1 in 1,000 solution of perchloride of mercury applied daily, as the disease is believed to be due to a micro-organism which grows easily in the sweat.

J. M. H. MACLEOD.

LICHENIFICATION.

Lichenification is a name which has been suggested for the series of changes which occur in the skin of certain individuals when it is subjected to incessant friction from rubbing and scratching for the relief of pruritus. It consists of a thickening and loss of pliability of the skin, the surface of which, when examined by oblique light, shows the presence of numerous facets, which are flat and glistening, and are separated from each other by the natural lines of the skin, which are unusually well marked. It may take the form of circumscribed patches, or be more diffuse and affect whole regions of the body, such as the legs, arms, abdomen and sides of the chest. The prognosis with regard to the circumscribed patches under suitable treatment is satisfactory, and they may be removed in a month or six weeks. If left alone, however, they may persist for years. The prognosis is contingent on that of the underlying pruritus, except that once the skin has become lichenified a vicious circle is established from the thickening, which irritates the nerve endings and so keeps up the pruritus, while the rubbing which is indulged in for its relief increases the lichenification. The rational treatment of this condition has three main objects, namely: (1) the removal of the cause and the allaying of the pruritus; (2) the increasing of the power of resistance of the individual; and (3) the removal of the thickening of the skin.

General Treatment.—The treatment for allaying the underlying pruritus is discussed in detail under Pruritus. To accomplish this successfully "the patient behind the disease" must be most carefully studied, the functions of every organ considered, and any obvious defect in general health corrected. In so many of the cases there is a definite nervous weakness, emotionalism or hysteria, which requires to be dealt with on common-sense lines. In other cases there is some general organic derangement, such as diabetes, or defects of the alimentary tract associated with auto-intoxication from ferments.

The resisting power of the individual is to be increased by tonics and fattening substances.

Local Treatment.—The objects of the local treatment are to reduce the irritation and to cause the retrogression of the lesion. The different anti-pruritic remedies have their special indications,

LICHEN PLANUS.

Lichen Planus is a disease which varies so greatly in different cases that each case must be considered on its own merits and treated accordingly. In one case it is a mild affection, consisting of a few small flat glistening papules situated about the wrist or knees, and comparatively amenable to treatment; in another, hypertrophic warty patches are present, raised several millimètres above the level of the skin, and varying in size from a sixpence to the palm of the hand, which resist almost every form of local application; and in a third type of case it forms a widely disseminated eruption, more or less symmetrically distributed over the whole skin, and associated with the most distressing itching and general symptoms. The cause of the disease is unknown, though there is some evidence to show that it is related to derangements of the nervous system; but whether these nervous disturbances are directly responsible for it or are simply predisposing agents, and the actual cause is some toxin circulating in the blood, is uncertain. Consequently the treatment is largely empirical, consisting of local applications with the object of obliterating the skin lesions and alleviating the itching, and a general *régime* to tone up the nervous system and correct any obvious defect in general health with which the disease may be associated.

The prognosis is invariably uncertain. In sub-acute cases it is practically impossible to predict how long it will take to disappear under treatment. In one case it may fade in a few weeks or months or even disappear spontaneously, in another new lesions may keep coming out, and so prolong the eruption for years. In the acute generalised cases the outlook is equally uncertain, for while in some instances it may be cured in four to six weeks it frequently takes much longer, and even when the greater part of the eruption has gone chronic residual patches may be left and the cure indefinitely postponed. It is not uncommon also for it to recur, sometimes at regular intervals, but as a rule irregularly, the recurrence being determined probably by some general derangement in health.

General Treatment.—There is no drug which can be regarded as a specific for lichen planus as mercury is for syphilis. In the past *arsenic* has had a great reputation in this connection, but its action is uncertain. In the acute generalised cases it may do more harm than good and aggravate rather than cure the affection. In sub-acute cases it occasionally produces beneficial results, but whether this is due to a direct specific action on the disease or simply to its action as a general nerve tonic is undecided. Consequently, in every case in which arsenic is prescribed it should be done with great caution, and the patient must be carefully watched in case deleterious symptoms be produced. It should on no account be given to patients who suffer from indigestion or other derangements of the alimentary tract, and should any symptoms such as colic or irritative diarrhœa supervene while it is being taken, it must at once be discontinued. The most convenient way of prescribing it is in the form of the liquor arsenicalis [U.S.P. liquor potassii arsenitis] in doses of from 2 to 6 min., or of the liquor sodii arsenatis, 5 to 10 min. [U.S.P. sodii arsenatis ex sicc., gr. $\frac{1}{22}$ to gr. $\frac{1}{11}$] in plenty of water, thrice daily after meals. It may also be given by hypodermic injection in the form of the liquor sodii arsenatis, 3 min. injected daily, and gradually increased until the limit of toleration is reached, or of one of the recently introduced organic preparations of arsenic, such as atoxyl and arsacetin. Certain observers have recorded satisfactory results from the injection of these organic preparations in this disease. Atoxyl is given in doses of $\frac{1}{2}$ to 2 gr. dissolved in warm water and injected twice a week, the dosage being regulated according to the body weight. The other members of the arylarsonate group, namely soamin, arsacetin, and orsudan, may be substituted for atoxyl in doses of 2 to 3 gr., injected twice a week. Of these preparations arsacetin and orsudan have the advantage of being more stable and less liable to disintegrate on being kept than the others. Further experience will show their relative therapeutic merits; in the meanwhile it is well to remember that they all contain a large percentage of arsenium and are liable to cause grave toxic symptoms, a few cases of blindness from double optic atrophy having resulted from their employment.

Mercury is a drug which seems to give, on the whole, better results in the treatment of lichen planus than arsenic, and the fact that it does act beneficially is a strong argument in favour of the toxic origin of the disease. It may be given in the form of hydrarg. cum cret., gr. 1 to 2, t.d.s.; hyd. perchlor., gr. $\frac{1}{16}$, t.d.s., or hyd. biniodid., gr. $\frac{1}{16}$, t.d.s., the amount being gradually increased.

Quinine and *salicin* have also their advocates. Salicin, in doses of 10 to 15 gr. thrice daily, not only exerts its anti-toxic action, but in a few cases, by its depressing effect, reduces the tension in the skin and calms the patient.

Antimony, in the form of the vinum (5 to 10 min. three times daily), is also of value in soothing the more acute cases.

For relief of the intolerable itching which is not infrequently associated with the eruption, antipyrin and phenacetin (10 gr. thrice daily) are of service. In the acute cases the general comfort of the patient must be carefully considered. In certain generalised cases the irritation may be comparatively slight, and the patient may be treated in an ambulant fashion and permitted to live his ordinary life. On the other hand, when the irritation is severe, to obtain good results the patient should be confined to bed, and every attention should be given to relieve the distressing irritation. The bedroom should be kept at an even temperature, the nightdress should consist of some non-irritating material, such as linen, and the bedclothes should be light. In the chronic cases a simple tonic *régime* with iron, strychnine, or phosphoric acid, or the employment of fattening remedies, such as milk, cream, cod-liver oil and pea-nut butter, may do more for the patient than any specific drug. The concomitant nervous condition of the patient must be dealt with by suitable measures, such as fresh air, a sea voyage, exercise, massage, cold or tepid douches, and change of air and occupation, as the case indicates. Any defect in general health, such as derangements of the digestion or disturbances of the liver and kidneys, must be treated on general medical principles.

Local Treatment.—In the acute generalised cases the first indication in the local treatment is to render the patient comfortable by reducing the irritation. For this purpose greasy ointments should be avoided and sedative anti-pruritic creams, lotions and powders should be resorted to. In the most acute cases the following calamine cream is of service: Calamine, ʒj; Zinc Oxide, ʒj; Lime Water, ℥ss; Oil of Almonds, ℥ss; Carbolic Acid, ♏5.

This should be pressed into the skin and followed by the application of a zinc oxide and starch dusting powder to which 2 per cent. of camphor has been added. A useful substitute for the cream is olive oil with the addition of 1 per cent. of thymol. Lotions of carbolic acid, lead and tar are also of value in these cases, such, for example, as the following: ℞. Acid. Carbolic. vel Liquor. Picis Carbonis, ♏10; Zinci Oxidi, ʒij; Liq. Plumbi Subacetatis, ♏10; Aq., ad ℥j. ℞. Liq. Plumbi Subacetatis, ♏15; Liq. Picis Carbonis, ♏10; Liq. Calcis, ℥ss; Ol. Amygd., ℥j.

In the less acute generalised forms relief may be obtained from medicated baths, such as creolin ($\frac{1}{2}$ oz.), borax and bicarbonate of soda (2 oz.), or starch and bran (2 lb.), to 30 gallons of warm water, or tepid sprays followed by cold douches.

In the sub-acute cases ointments are permissible, but even in these they should be prescribed with caution at first in case they should produce irritation. One of the favourite ointments contains mercury and carbolic acid, as follows: ℞. Acid. Carbol., gr. 20; Hyd. Perchlor., gr. 2; Ungt. Zinc. Oxid., ad ℥j.

Instead of mercury, tar may be employed, either in the form of oil of cade 10 min. in an ounce of lanolin, soft paraffin, or cold cream, or in the following formula: ℞. Liquor Picis Carbonis, ♏10; Liquor Plumbi Subacetatis, ♏15; Ungt. Zinc. Oxidi., ad ℥j.

To obtain the full benefit of these ointments they should be kept continuously applied, spread on lint under a bandage.

The most resistant lesions of all are the hypertrophic and verrucose patches. In treating them much stronger remedies may be applied with impunity, such as salicylic or pyrogallic acid (3 to 6 per cent.) in an ounce of vaseline. A convenient substitute for the ointments are the different Beiersdorf plasters, of which the most useful are those containing mercury, salicylic acid and carbolic acid.

By far the best remedy, however, for these hypertrophic lesions is the X-rays, for they not only set up a process of retrogression, but at the same time relieve the irritation. A full Sabouraud pastille dose should be given to each lesion. When the patches are only slightly raised one dose may suffice, but, as a rule, a second or even a third is necessary. These subsequent doses should not be given at a shorter interval than a month, and the healthy skin around the lesion should be carefully protected during the exposures.

In association with lichen planus lesions frequently occur in the mucous membrane of the mouth, and especially affect the insides of the cheeks and the tongue. These mucous lesions should be treated by soothing remedies, such as gargles of potassium chlorate or myrrh. On no account should an attempt be made to destroy them by caustic remedies, such as chromic acid or silver nitrate, for fear of irritating the lesions, and in elderly people of setting up malignant changes. Irritating foods, such as hot drinks, mustard, pickles and pungent substances in general, should be avoided, and smoking should be prohibited. The teeth should be looked to and any sharp edges dealt with, and the mouth kept in as clean and hygienic a state as possible.

J. M. H. MACLEOD.

LUPUS ERYTHEMATOSUS.

Lupus Erythematosus is one of the most intractable and capricious of skin affections. In some cases it tends to spontaneous involution, in others it may disappear in a few weeks or months, apparently as the result of some form of local or general treatment, while in not a few cases it seems to persist indefinitely in spite of all manner of treatment. In certain cases it would seem to die out eventually, in others it persists to old age.

In order that the treatment may be somewhat rational it is essential that the physician should possess some knowledge of the etiology and pathogenesis of the disease. Unfortunately our knowledge of its true nature and causation is most imperfect. Many observers in the past and a certain number in the present still adhere to the view that it is an expression of tuberculosis, not due like lupus vulgaris to the presence of the tubercle bacilli in the skin, but resulting from the action of the tuberculous toxin which has reached the skin by the blood-stream and has been produced by bacilli situated in some remote tuberculous focus; in other words, that lupus erythematosus belongs to the class of skin affections which have been designated in France the toxi-tuberculides. It seems to me, however, that there is insufficient evidence, either clinical, histological or bacteriological, to prove that it is causally connected with tuberculosis, and though it occasionally occurs in association with tuberculosis, which is after all a common disease, the association is probably accidental. That it does not result from the tuberculous toxin is borne out by the fact that in spite of the vast number of injections of the old and new tuberculins which have been given for diagnostic and curative purposes there is no instance so far as I am aware in which such an injection has called forth an eruption of lupus erythematosus. A study of lupus erythematosus in its many aspects suggests that it is not in the true sense a pathological entity due to one specific cause, but is rather a morbid condition of the type of an erythema which is persistent in character, and tends to be succeeded by atrophy, and which may be brought about by a variety of causes in a predisposed individual. The probable causes of the condition may be thus briefly summarised.

Predisposing Causes.—As predisposing causes may be cited (*a*) hereditary weakness; (*b*) enfeebled states of health resulting from any general morbid condition, of which tuberculosis and rheumatism are probably examples; (*c*) a weak peripheral circulation, and various circulatory disturbances arising from anæmia, morbus cordis, etc.; and (*d*) a delicate condition of the blood-vessels owing to anatomical reasons in the situations usually affected by the disease.

Direct Causes.—(*a*) Local causes, of which the most common are atmospheric influences, such as colds, sudden changes from heat to cold, occasionally sunlight, traumatism, bites from mosquitoes or other insects, or local microbic action; and (*b*) toxins reaching the skin by the blood-stream, such as toxins resulting from imperfect metabolism in the alimentary tract, or from a defective state of the kidneys, liver or other organ.

The long and disappointing list of drugs which have been put forward from time to time as internal or local specifics for this affection is in itself an indication that our methods of treatment are somewhat uncertain, and have been based rather on empiricism than on a clear understanding of the nature of the disease. The treatment to be adopted varies according to the type of case. There are two chief varieties, namely: (1) The discoid or circumscribed type, which is chronic in its evolution and course; and (2) the disseminated and more or less acute type. Of the former there are several sub-varieties, namely: (*a*) A well-defined lesion with a more or less raised border and an adherent scale in the centre, which feels rough and on being raised up reveals the presence of horny plugs extending down into the follicles (seborrhœa congestiva of Hebra); (*b*) a non-scaly type, in which the lesions are raised and pinkish red in tinge like those of a toxic erythema; and (3) a variety in which the most marked feature is the presence of telangiectases over the lesions. In a disease so multiform as this it is obvious that the treatment must vary to an unusual extent, and not infrequently failure to benefit the condition is the result of an injudicious choice of the remedy for the individual case. The treatment is naturally divided into general and local treatment, and of the two the local treatment is the one which up to the present has afforded the best result. Certain cases have been undoubtedly cured by local means alone, but great benefit can be derived from the judicious combination of both. Cases of the acute generalised type may clear up under general treatment where practically no local treatment has been employed.

General Treatment.—The general treatment of lupus erythematosus is based on general medical principles rather than on any form of specific internal medication. In many of the cases there is definite evidence of a lowered vitality associated with a weak peripheral circulation. This may be the result of a variety of causes, such as hereditary or acquired disease, disturbances of the alimentary tract, anæmia, or diseases of the heart, kidneys or other important organs. Such defects must be carefully sought for and dealt with by appropriate means. It is of importance also that everything which tends to cause marked dilatation of the cutaneous blood-vessels, such as alcohol, condiments, etc., should be avoided, unless in small regulated quantities in exceptional circumstances. By these general means, especially if the disease is in its early stage, the resisting power of the blood-vessels may be so increased that various local causes though still active will only produce a re-active hyperæmia, transient in type, like a patch of erythema or an ordinary chilblain, and will not become persistent or go on to degeneration and atrophy.

In more or less acute and disseminated cases in which the disease results directly from toxins circulating in the blood, the obvious indication is to eliminate or to neutralise the toxins. As the exact nature of the toxins responsible when the disease is associated with such general toxæmias as result from nephritis, disease of the liver, rheumatism, etc., is uncertain, the appropriate anti-toxin is not available, but various drugs are employed which are known to have an anti-toxic action, such as quinine and salicin. Salicin has been strongly recommended by Radcliffe Crocker, in doses of 15 gr. three times a day, increased later to 30 gr. Besides its action on the toxin salicin is a cardiac depressant and reduces the cutaneous hyperæmia. Quinine was recommended by Payne, its action being intensified by painting the lesions at the time with tincture of iodine, favourable results having been recorded by this combined method. Various other drugs have been employed, such as arsenic, iodide of potassium, and ichthyol, the last-named being used extensively by Unna, in doses of 5 min., in capsules three times a day. The results from these drugs are, as a rule, disappointing, and more benefit can usually be derived from the treatment of the patient on general principles than by reliance upon them.

Local Treatment.—Before commencing any form of local treatment it is important to impress on the patient the necessity of protecting the skin as far as possible from the direct causes of the disease, of which the most potent are probably cold and exposure to rapid and great changes of temperature. In order that the local treatment may be rational in character, it is necessary to appreciate the different features of the histology of the lesions. These may be tabulated briefly as follows: 1. In the early lesions there are (*a*) marked dilatation of the capillaries in the upper part of the corium; (*b*) œdema in the same layers with a rarefaction of the white fibrous tissue; (*c*) a cellular infiltration localised chiefly round the blood capillaries, and consisting of polynuclear leucocytes, small round mononuclear cells, a few spindle-shaped cells, and an occasional mast-cell; (*d*) œdema of the deeper portion of the epidermis; (*e*) thickening in places of the prickle-cell layer; and (*f*) thickening of the stratum corneum, extending down into the mouths of the follicles, and where the underlying œdema is excessive, an imperfect cornification with the formation of a scale. 2. In older lesions the hyperæmia and œdema are less marked, but the blood capillaries may be blocked up with cells, the endothelial lining degenerated, and the cellular deposit more formative in character, and evidently in process of causing atrophy.

These histological characteristics indicate in the first place that, however successful the local treatment may be, once the lesion is in the second stage, atrophy is bound to follow, but if the lesion is made to involute in its early stage, there is a possibility of its disappearing without leaving marked traces behind it. Except in its final stage the lesion of lupus erythematosus is essentially moist. On the actual surface there is a covering of dry, horny material, which is more or less scaly, but the deeper portion of the epidermis and the upper layers of the corium are markedly moist. Unna has aptly compared the histology to a bog covered with a layer of green moss which looks firm, but which is unsafe to step on.

In connection with the local treatment it is of the utmost importance to remember that it is easier to do harm than good by local applications in lupus erythematosus. The remedies should, therefore, be most carefully chosen for each case, and it is always better to err on the safe side and begin with mild applications, the strength of which can be gradually increased as the toleration of the individual is estimated.

The first indication in the local treatment is *the removal of the adherent scales*. For this purpose the lesions should be rubbed with soap-spirit lotion on a piece of moist flannel, or an ointment or plaster containing 2 per cent. of salicylic acid should be applied.

After the removal of the scale, the next indication is *the drying of the lesion*. This can be done by bland powders to absorb the moisture, by lotions containing an insoluble deposit, which act by evaporation and by leaving a coating of powder on the surface, and by pastes. A useful powder consists of equal parts of zinc oxide and magnesium carbonate, the latter absorbing a larger quantity of moisture for its bulk than any other powder. One of the best lotions is the zinc calamine lotion containing: Prepared Calamine, gr. 15; Zinc Oxide, gr. 10; Glycerine, ♏20; Lime Water, ʒj; Rose Water, ad ℥j.

A serviceable paste is the following: Zinc Oxide, ʒjss; Starch, ʒij; Lanolin, ʒij; Soft Paraffin, ʒij.

A further indication is *the reduction of the hyperæmia* and vascular dilatation, and for this purpose ichthyol, which has the reputation of being able to reduce congestion locally, may be employed with advantage. It is generally used as an ointment with vaseline in strengths of 3 to 10 per cent., or the following formula may be employed: Ichthyol, ♏15; Zinc Oleate, ʒij; Rose-water Ointment, ad ℥j. It may also be added to the above paste, and in this way two objects are achieved by one application. In using both the ointment and the paste it is of importance to keep them applied continuously. For this purpose they may be spread on lint, or employed in the form of a plaster.

Another method of using ichthyol is in a lotion (3 to 6 per cent.), dissolved in water or 50 per cent. alcohol. This should be pressed into the skin several times a day, and a bland dusting-powder subsequently applied.

Formalin is another drug with an astringent action which has been recommended in this connection. It may be used in the form of a 5 to 10 per cent. ointment, in equal parts of lanolin and soft paraffin. As it is apt to irritate delicate skins, it should be used with caution in the first instance. Adrenalin has also been recommended, and may be employed as a lotion (1 in 1,000) and pressed into the skin. On the whole, ichthyol is the most useful of these remedies.

A mechanical method of reducing the hyperæmia by means of continuous pressure, which is simple and sometimes effective, is to paint the lesions two or three times daily with collodion; to this may be added 1 per cent. salicylic acid to reduce the scaliness.

These various applications, with the exception of formalin, are of a bland description, and give better results than the caustic remedies which were once extensively employed, such as acid nitrate of mercury, sublimate, silver nitrate and carbolic acid. These are essentially destructive in character, and though they are all capable of removing the lesion they are apt to do so at the cost of an unsightly scar. They should only be resorted to in the case of small circumscribed lesions covered with a thick scale. Of the milder caustics, two of the most useful are oxidised pyrogallic acid (6 per cent.) in a paste applied daily, and resorcin (10 per cent. solution in spirit) painted on the lesions once a week.

In the case of very small lesions *operative measures* may be employed, such as multiple scarification, electrolysis, and the actual cautery; great care, however, must be exercised in operating to avoid undue scarring.

Various *electrical methods*, such as high-frequency currents, Finsen light, X-rays and ionisation, have been employed with greater or less success in the local treatment of lupus erythematosus. In the choice of one or other of these methods for the treatment of an individual case it is important to bear in mind that lupus erythematosus is much more easily aggravated than cured, and whichever form of treatment is decided upon, it should be begun in the most cautious and tentative fashion.

Of the electrical methods, *ionisation* with zinc is by far the most reliable, and of all methods of local treatment at present at our disposal probably gives the most uniformly good results. It is suitable for the treatment of all forms of circumscribed lupus erythematosus. The method is simple, and consists in applying a piece of lint saturated in a 2 per cent. solution of sulphate of zinc to the lesion. On this is pressed a flat zinc block electrode attached to the positive pole of a galvanic battery. The negative pole, consisting of a metal cylinder covered with chamois leather and dipped in saline solution, is grasped by the patient, and a current of 2 to 5 milliampères is passed for ten to fifteen minutes, the strength of the current being determined by the toleration of the patient. After the exposure a bland zinc protective paste is applied to the part. The electrodes should be chosen to suit the size of the lesion to be treated, and the moistened lint should be cut slightly larger than the base of the electrode. Where the lesion is large it may have to be treated piecemeal, and care should then be taken to avoid overlapping. As a result of the exposure the tissue becomes blanched like parchment, and continues so for a varying time, according to the strength of the current employed. If the exposure is not excessive, no subsequent reaction should take place; if it is too prolonged, or the current too great, superficial ulceration may be produced. A practical point in connection with the treatment is that the negative pole should be large, and should be moved about from one position to another, as when kept too long at one place it is apt to cause an intractable necrotic ulcer. The treatment should be repeated at weekly intervals. Certain cases practically clear up after a single application, others require several, while in a few there is no appreciable benefit from the treatment.

With regard to the value of the *X-rays* in the treatment of this disease my experience has been disappointing, and in the cases I have treated by them no distinct benefit was derived. In small doses the rays are stimulating to the skin and may irritate the lesions, and in large doses they are contra-indicated, since they cause permanent dilatation of the vessels if pushed to the extent of a reaction, and this is one of the conditions in lupus erythematosus which we are endeavouring to cure. Of course it is possible to replace a patch of lupus erythematosus by an X-ray scar, but by so doing the cure is worse than the disease.

Radium has also been employed in the treatment of circumscribed lupus erythematosus, as it is believed to have a selective action on the blood capillaries, causing them to disintegrate and to become replaced by new fibrous tissue. As in the case of the X-rays, care should be taken to control the exposure, so as to avoid producing a dermatitis with subsequent scarring and telangiectases.

The *Finsen light*, however, often gives beneficial results, especially in old-standing lesions covered with thick adherent scales. In such cases the exposure to the Finsen lamp should be given in the ordinary way, employing a compressor, and attempting to get a reaction. When the lesions are extensive and superficial in type, the plan suggested by Norman Walker, of exposing the skin at a distance of 10 inches from the lamp without a compressor for half an hour every second day, may give improvement, while the ordinary method of exposure may aggravate the lesions. Theoretically, the reaction from a Finsen lamp should result in the breaking up of the degenerated capillaries and the removal of the cellular infiltration. Unfortunately, the vessels, being in a weakened state, the reaction which occurs is of a feeble type in the cases which are benefited, and it scarcely occurs in those which do not improve under the action of the rays.

Other electrical methods have been suggested, such as high-frequency effleuves, static discharges, and faradisation, but these are of little or no value, and are apt to aggravate rather than improve the condition.

The most recent method of treatment of this affection is by means of *refrigeration by liquid air or solid carbon dioxide*. For various reasons the carbon dioxide snow is the more practical of the two; it is much cheaper, and its application is more simple and accurate. The method which I have found most convenient is to press the snow into specula-shaped applicators made of vulcanite, varying in size from ¼ to 1 inch in diameter, by means of tightly fitting plungers. An applicator is chosen, the diameter of which is slightly larger than the lesion, or if the patches are extensive they are treated piecemeal. An application of from five to ten seconds is given with medium pressure. The results obtained from this form of treatment vary considerably and are uncertain. In several cases of the circumscribed seborrhœic type, where the lesions were situated on soft parts like the cheeks, the results have been satisfactory. When the lesions occurred in situations in which the skin was particularly thin, and stretched over bone or cartilage, or in elderly people, the treatment was apt to produce an intractable type of superficial ulceration. In any case, the exposures should be short. The treatment, on the whole, is less satisfactory than zinc ionisation, the scarring following its use is probably more marked, and in unsuitable cases it may aggravate the condition rather than improve it.

J. M. H. MACLEOD.

MELANODERMA.

THIS term is applied to the darker and more extensive forms of Chloasma, *q.v.*

F. GARDINER.

MILIUM.

THIS does not cause much inconvenience unless the papules grow to a large size or become calcareous. Pricking with a needle and squeezing out the contents may suffice, but electrolysis is a better plan and much more thorough.

When the papules are very numerous, a 10 per cent. resorcin or salicylic ointment may be used to cause exfoliation.

F. GARDINER.

MOLLUSCUM CONTAGIOSUM.

THIS disease may disappear spontaneously, but treatment is usually advisable A most satisfactory method is to touch each of the small pearly growths with a fine electro-cautery. When there are many to be treated, it is advisable to rub in a 3 per cent. stovaine ointment for a few hours beforehand to render the skin less sensitive. Squeezing them out or scraping with a small curette is also a very satisfactory method. When there are a large number of lesions situated on the trunk, it is usually advisable to disinfect the clothing by heat, for although the actual infecting cause is unknown, there is no doubt as to its being contagious. When the disease is situated on the face, as it is in many cases, disinfection is unnecessary.

In dealing with young children, in whom any form of operative treatment is difficult, it is best to touch each little growth with a match dipped in 1 in 20 carbolic acid and cover with collodion.

Tincture of iodine may also be used in the same manner on a pointed match.

WILFRID S. FOX.

MOLLUSCUM FIBROSUM: VON RECKLINGHAUSEN'S DISEASE.

Although these two terms are not considered by most authorities to refer to quite the same clinical picture, for the purposes of treatment they may be considered together. In cases in which there are only a few pedunculated tumours, these can be snipped off with a pair of scissors and the bases touched with a stick of silver nitrate. This is specially advisable when the growths are situated in the region where they are likely to be pulled, torn, or irritated in any way. In cases in which, in addition to the pedunculated tumours, there are subcutaneous painful nodules directly attached to nerves, the excision when carried out must be thorough; otherwise the nodules will in the majority of cases recur. In cases where there are a very large number of growths only those which are giving trouble should be treated. There is no general treatment which has any effect either in preventing fresh growths coming out or in arresting those already present. The pigmentation in Von Recklinghausen's disease, occurring as it usually does on the trunk, requires no treatment. The pruritus which is sometimes associated with the small growths can be relieved by the usual anti-pruritic drugs, for example, 1 in 60 carbolic lotion, followed by a dusting-powder of zinc oxide and boracic acid, equal parts; or if an ointment is more suitable, one consisting of: Mentholis, Acidi Carbolici, āā ʒss; Zinci Oxidi, ʒj; Adipem Benzoatum, ad ℥j.

Occasionally the galvano-cautery or Paquelin's cautery is more successful in destroying the nodules and in preventing new growths than excision.

In those cases in which large pendulous masses usually about the head and neck occur, appropriate surgical treatment should be undertaken whenever possible.

WILFRID S. FOX.

MONILITHRIX.

Treatment for this disease is of little or no avail.

Sulphur and salicylic ointments, the use of massage, and electricity are recommended as helpful by some authorities.

Cranston Low[1] has given a full account of the subject in dealing with a series of cases. He found high-frequency treatment to be the only treatment which was even of partial service.

F. GARDINER.

Reference.

[1] Journ. of Pathol. and Bacterol., Camb., 1909--10, XIV., p. 230.

MORPHŒA.

This is a condition of the skin which generally disappears spontaneously, but in which local measures are of distinct value in shortening the time. Massage and X-rays are the most useful methods, but they have to be used for a considerable period.

More details will be found under Scleroderma, of which it is a localised form.

F. GARDINER.

MYCOSIS FUNGOIDES.

(*Synonyms.*—Granuloma Fungoides; Lymphodermia Perniciosa.)

This rare disease, the treatment of which until recently was very unsatisfactory, is now, in the majority of cases, greatly improved, and occasionally cured by exposure to X-rays, both in the premycotic stage, when it is chiefly a question of relieving the intense itching, and later in dealing with the fungating tumours. The effect of X-rays in resolving the lesions is striking, but several cases which were apparently cured by this means have relapsed; they are as a rule, however, controlled by X-rays, even after repeated relapses. The X-ray exposures should be given in the usual three-quarter Sabouraud dose every fortnight (*see* Ringworm). According to some authors this disease will tolerate X-rays in very much larger doses than this, that is to say, in larger doses than the healthy skin will normally tolerate. There is, however, as a rule, no necessity to hurry matters in this way, and the risk of producing a serious burn is not worth running.

Where X-rays are not available, arsenic and salicin appear to be the only two drugs which have any effect. Arsenic may be given either in the form of Fowler's solution, starting with 3-min. doses and increasing until toxic signs appear, or by injection of one of the more complicated organic arsenical compounds which have recently come into vogue, such as orsudan, arsacetin, or soamin; 4 cubic centimètres of a 10 per cent. solution of any of these should be injected three times a week, careful watch being kept for toxic signs, especially eye symptoms. If the practitioner remembers that these drugs are dangerous when used recklessly, there is very little risk; in nearly all the cases where disasters have occurred, either enormous doses have been used or the cumulative effects have been forgotten. A total of 45 to 50 cubic centimètres is the usual maximum limit. Atoxyl is, of course, a much more dangerous drug on account of its irregular strength.

Salicin should be given in 15-gr. doses three times a day. Locally resorcin ointment, 20 gr. to the ounce, or in 10 per cent. pyrogallic acid ointment, may give some relief. In dealing with fungating masses, the ordinary local antiseptic treatment should be carried out, for if these cases are neglected, the majority of the patients die from septic absorption. Frequent bathing with boracic lotion, or with peroxide of hydrogen, is usually the safest form of treatment, and astringent dusting-powders, such as the subgallate of bismuth, are useful.

WILFRID S. FOX.

NÆVI (MOLES, BIRTH MARKS).

THE chief agencies which are used for the removal of these deformities are radium, carbon dioxide snow, liquid air, electrolysis and excision. Each case must be considered on its own merits as to which would be the most appropriate treatment, but special varieties of these birth marks may indicate one method as preferable.

Spider Nævi, or Stellate Nævi, occurring as they do some time after birth, and frequently well on in adult life, are best removed by electrolysis. It is advisable in children to give a general anæsthetic, especially if the nævus is situated in the neighbourhood of the eye, as is so often the case. With adults a local anæsthetic, preferably a small injection of novocaine and adrenalin, is all that is necessary, the operation being somewhat painful unless something is done to anæsthetise the skin. The needle attached to the negative pole is inserted into the large central blood-vessel, and a current of 2 to 3 milliampères is passed, the patient holding the positive pole; this is continued until the vessels are thoroughly blanched and there is a fair amount of frothing. Some authorities prefer to reverse the current after a little while, and then go back again to the negative. If this is done, the operator should be careful when using steel needles not to continue the positive electrolysis for more than a few seconds, otherwise small black marks will be left, due to driving in of iron ions from the needle. If the needle is really satisfactorily passed through the central blood-vessel, one sitting is sufficient; if not, the operation will have to be repeated in a few weeks' time. It is better, however, to do too little at a time and to have to repeat, rather than to do too much and to produce a small necrosis resulting in a pit.

These stellate nævi can be cured by carbon dioxide, but the results are not so satisfactory as with electrolysis.

For the **port-wine stains** radium gives the best results; the dosage required can only be gauged by the operator from his own experience of the radium at his command. It is advisable, however, not to cut out all the softer rays, as a certain amount of inflammatory reaction appears to be beneficial in these cases. When carefully carried out, there is very little in the way of scarring; the epidermis being quite sound over the whole surface, the colour is good, not dead white, and it is quite possible to avoid producing telangiectases. The method is, of course, expensive, and it is advisable to do it slowly, to avoid giving too big a dose.

Carbon dioxide, if persisted with, does give fair results with port-wine stains; but it is necessary to go very carefully and to feel one's way, not trying to do much at a time. However, even when the port-wine stain is completely removed by CO_2, the result is not nearly so good from a cosmetic point of view as that procured by radium. The operator should be warned that it is inadvisable to try combining these two methods, especially if radium is used first and CO_2 afterwards. In one case in which the writer thought more rapid progress might be made by changing the treatment in this manner the result was by no means satisfactory. In the situations where CO_2 was applied there was an unusually aggravated reaction, which ended in producing a hypertrophic scar which showed a number of injected venules.

Electrolysis in port-wine stains is most unsatisfactory. Even after repeated sittings the result is usually a pitted, unevenly coloured surface.

Small capillary nævi which from their situation it is inadvisable to excise can be treated almost equally well either by CO_2 or by radium. It should not be forgotten, however, that a very large proportion of those capillary nævi which are excised from infants, more particularly from the scalp, tend to atrophy of their own accord after the age of two years, and the faint stain which is left is of no consequence in the hairy scalp.

The *carbon dioxide snow* is prepared by allowing the rapid escape of the gas from a cylinder into a bag or towel tied up around the knob of the cylinder. When a sufficient amount of snow has been deposited on the bag it is collected in a spoon and put into a suitable localiser. This consists of a square or circular tube whose diameter corresponds roughly with the area to be treated. A solid rod, which fits accurately this tube, is then used to pound the soft snow into a solid mass. When this is done the frozen candle, as it is called, is expressed from the tube by the rod on to a piece of wool; it is wrapped in the wool and held in the hand while applying, the object of the wool being to protect the operator's hand. The point can then be cut with a knife until a surface has been procured which coincides accurately with the nævus to be treated; the operator then presses the end of the candle against the nævus, and holds it firmly in position for a given length of time. The length of the application depends more than anything on the amount of pressure used by the operator, and it is this which he must learn by experience to gauge—*e.g.*, an application for fifteen seconds at a firm pressure will have in all probability more effect than a gentle application for double the time.

There is very little pain during the operation, many children smiling the whole time; during the thawing process afterwards there is, as a rule, an unpleasant tingling sensation. The reaction shows itself within a few hours usually in a moderate dose in the shape of a blister corresponding in diameter to that of the candle; this should be kept clean and protected either with calamine lotion, boracic acid ointment or weak white precipitate ointment. In a fortnight's time or so, when all reaction has quieted down, the process can be repeated if necessary. It should be remembered that it is always better to go slowly and repeat the operation several times rather than to overstep the mark by giving too big a dose, for if superficial sloughing is produced the ulcer is of an indolent type and takes a considerable time to heal. It is advisable to be specially careful in the first application in order to find out the resistance of the individual; later the dose may be increased. Vascular nævi on account of their copious supply of nourishment will usually bear a longer exposure than moles. In an infant the first application should not be longer than fifteen seconds, the maximum, as a rule, at the second or third application being twenty-five to thirty seconds.

Radium also gives excellent results with capillary nævi, but on account of the greater expense one ranks it after CO_2 as routine treatment. It is, however, better than CO_2 in dealing with large nævoid tumours where there is considerable enlargement of the deeper vessels, radium having a selective action upon young pathological vascular tissue. It is, of course, generally a much slower method of cure than the CO_2, but the resulting scar is usually better, especially in the more extensive cases where CO_2 would have to be repeated several times to produce a result. Radium is also far more reaching in its effects—thus, *e.g.*, if a nævus situated on the cheek penetrates right through the whole thickness on to the buccal surface, it will be found that after exposure to radium on the outside there is considerable improvement on the inner surface as well.

Electrolysis for capillary nævi does not compare with either of these other processes; it is usually necessary to repeat the operation several times, and even then the result is by no means always satisfactory. In children it is always necessary to give a general anæsthetic, which is an additional drawback to the treatment. When carried out, it is best to use a multiple needle, that is to say, five or six needles, all of which are attached to one pole, or else half of them in connection with the positive pole and half with the negative; in the latter case, of course, no pad is required. When all the needles are attached to one pole it is advisable that this should be the negative to start with, then reverse to the positive and then back again to the negative; the needles should then be moved and inserted into different parts of the mass, and the same process repeated several times, according to the size of the tumour. The current which is usually employed is 2 to 3 milliampères through each needle, that is to say, when five needles are used at once the amount of current should be from 10 to 15 milliampères.

Excision.—In nævi which are not situated on the face, or where a linear scar is not a great detriment, excision is, of course, an extremely rapid method of removal in the case of the small circumscribed capillary nævi when the underlying vessels are not of very great size and likely to ooze much, a consideration which is of some importance in infants.

Liquid air has no advantages over carbon dioxide; it has the disadvantage of being more expensive and rather more painful.

Vaccination over a capillary nævus is quite a satisfactory method of treatment when the nævus is situated in such a position that a very pretty cosmetic result is not of very great importance. It is, however, not a very clean method, and there is always a slight risk of sepsis. To carry it out minute punctures must be made all over the surface of the nævus without producing very much hæmorrhage. After the oozing has stopped the lymph is rubbed in over the surface in the usual way. If this is done when there is a considerable oozing, the lymph is apt to be washed away.

Pigmented moles, when quite small, can be treated satisfactorily by electrolysis in the method described above, provided that the patient is young. It should be remembered that it is inadvisable in dealing with adults to employ any treatment which may irritate a pigmented mole and not completely destroy it, as in several instances malignant nævo-melanomata have resulted. It is, therefore, best in adults always to excise a mole, especially if there is any sign of increase in size or in pigmentation, or the mole is in such a situation that it is liable to be rubbed or torn. Excision gives the additional advantage that a microscopical examination can be made, and the operator is then in a position to know the condition of innocency or malignancy with which he is dealing. Chemical caustics and actual cautery, unless very thoroughly carried out, are particularly prone to make innocent moles malignant in adult life. However, the majority of cases come up for treatment as children, and when the mole is too large for electrolysis, that is to say, bigger than a split pea, the carbon-dioxide method described above gives the best and quickest result, destroying at the same time the excessive growth of hair. For this variety of birth marks carbon dioxide appears to give better and quicker results than radium, although, of course, the latter will destroy moles in quite a satisfactory manner. Linear or warty nævi are best destroyed with the actual cautery under a general anæsthetic. Care should be taken not to do too much at a time, and to avoid too deep scarring, especially in the regions of the axillæ and flexures. Dry dressings of boracic powder are best after the operation. Chemical caustics are more painful, and generally lead to suppuration. The verrucose masses may sometimes be removed by X-rays, but tend to recur.

WILFRID S. FOX.

DISEASES OF THE NAILS.

Onychia has to be managed on ordinary antiseptic lines by cutting away as much as possible of the affected nail and skin adjoining. Treatment consists in soaking in boric lotion or peroxide of hydrogen, with the subsequent application of antiseptic ointments.

Hypertrophy and Malformation of the Nails are best treated by preventitive measures. As they generally occur on the feet, and are due to lack of regular cutting and the use of badly fitting footwear, the patient must be given definite instructions on these evils. When fully formed, soaking in solutions of bicarbonate of soda, and subsequent scraping and cutting, are the chief methods of alleviating the discomfort.

Tuberculous Onychitis is managed on the usual lines, with administration of tuberculin and local treatment.

Syphilitic Onychitis must be attacked by local and general anti-syphilitic remedies. In these cases removal of the nail is often necessary.

Atrophy being mostly due to some constitutional trouble, is best suited by general tonics, and arsenic gradually pushed is most successful. The nails themselves should be protected from injury and soothing ointments applied.

Eczema likewise responds best to arsenic, but the local measures are very important. Equal parts of lead plaster and vaseline are to be kept continuously on the affected regions by spreads of linen. With each fresh application some of the ointment should be carefully pressed under the free edge and sides of the nail, and also into the lunule. Gaucher[1] prefers 5 per cent. salicylic acid ointment or pure oil of cade. Walker[2] favours the use of 2 to 10 per cent. of resorcin in spirit during the day and ungt. picis at night, rubber finger-stalls being worn. The state of the part must determine the measures to be applied, and it is safer in the more acute cases to apply lead and vaseline in the first instance, and follow later with tar or other strong application.

Ringworm and Favus are very obstinate and necessitate much care and perseverance. Scraping or cutting away of as much of the nail as possible is the first step, and then soaking in a 2½ per cent. solution of sodium bicarbonate all night will allow more to be removed. It is important not to use too strong an alkali, as a troublesome dermatitis is apt to result; rather, therefore, begin with weak solutions and increase if necessary. When the nail is softened it allows better penetration by antiseptics, such as 5 per cent. copper sulphate in water, which should be kept on in the form of soaks. Harrison's method also yields good results if persisted in, but in all these plans one must persevere for weeks, till no trace of disease is noticeable. Potass. iodid., (½ drachm in 4 drachms each of liq. potass., and spirit. vini rect.) should be kept on for five to fifteen minutes, and then mercuric chlorid. (4 gr. in 4 drachms each of spirit. vini rect. and water) is to be applied for the rest of the day on soaks.

Favus is treated in the same way as ringworm.

F. GARDINER.

REFERENCES.

[1] Gaucher, E., "Diseases of the Skin," transl. Lond., 1910.
[2] Walker, Norman, "Introduction to Dermatology," 5th ed., Edinb., 1911.

PARAPSORIASIS.

The term "parapsoriasis" has been applied by Brocq to a number of cases of psoriasiform and lichen-like eruptions which do not conform to psoriasis, lichen planus or any of the ordinary recognised types of skin disease, but which though differing in minor details have so many essential features in common as to warrant their inclusion under one heading. To this group of disease Colcott Fox and the writer suggested in 1901 the non-committal term of "maculo-papular scaly erythrodermias." Under this heading several distinct varieties of eruption are included: namely, a guttate form, in which the lesions occur as scaly macules; another in which the maculo-papules coalesce to form a reddish network widely distributed over the skin; and a third type, in which they are aggregated into more or less well-defined patches.

The prognosis varies considerably in different cases; it is extremely bad in the widely distributed reticulate variety, neither local nor general treatment appearing to have any effect upon it; while in the guttate and patchy types improvement and even cure may be obtained by the thorough application of strong local remedies.

As the etiology and pathogenesis of this condition are unknown, the treatment is purely empirical, and since it usually occurs in those who are apparently in good health, there is, as a rule, no definite indication for general treatment. The different internal remedies which have been used with greater or less success in psoriasis and lichen planus, such as arsenic and salicin, have been tried in this group of diseases, but with no marked benefit.

Locally the comparatively mild keratolytics which are capable of curing seborrhœic dermatitis and of greatly benefiting psoriasis, such as ichthyol, resorcin and sulphur, have little or no effect on these eruptions, and stronger remedies are necessary. In the guttate and patchy varieties benefit can be derived from the rubbing in of an ointment containing pyrogallic acid, and a formula such as the following will be found useful: Oxidised Pyrogallol, gr. 10 to 30; Glycerine of Starch, ʒij; Soft Paraffin, ad ℥j. This ointment may be further enforced by the addition of 2 per cent. of salicylic acid. After a bath and the removal of the scales by soft soap the above ointment should be rubbed into the individual lesions. If the disease is very extensive, as in the reticulate variety, this procedure is contra-indicated in case of absorption of the drug taking place with the production of toxic symptoms. In every case where pyrogallic acid is being used extensively, it is advisable to test the urine frequently, and if it is discoloured by the drug, to suspend its use at once. In place of pyrogallic acid, Crocker recommended vasogen-iodine (10 per cent.) to be thoroughly rubbed in for ten minutes, which is much less toxic in its action and equally effective.

The X-rays may be employed in the treatment of isolated patches and with considerable success. About three-quarters of a Sabouraud pastille dose should suffice to cause the patch to fade, and if it is insufficient, a second exposure may be given in a month.

In the widely distributed reticulate cases strong remedies are dangerous, and are apt to set up by their irritation an exfoliative dermatitis. Consequently, in them it is advisable to be content with milder measures, and to aim rather at keeping the skin comfortable than at wiping out the eruption, in the hope that the disease will eventually disappear spontaneously. For this purpose warm alkaline baths and soothing applications, such as resorcin (gr. 30) or salicylic acid (gr. 10) in an ounce of glycerine of starch will be found to be of most value.

J. M. H. MACLEOD.

PEDICULOSIS.

The three forms of Pediculosis capitis, corporis, and pubis, are all easily cured by any disinfectant application, if the patient will only take the trouble to apply it thoroughly.

Pediculosis Capitis.—This condition is easily cured by rubbing Unguentum Hydrarg. Ammon. twice daily into the scalp, especially into the area around the sub-occipital fossa, where the parasites are most apt to lurk. Before each application of the ointment, the head should be well washed either with soft soap and warm water, or with the usual soap spirit lotion (soft soap and rectified spirit, equal parts). This softens the crusts and gummy material exuded by the pediculi, and enables the ointment to penetrate further. It is never necessary to cut the hair of girls, if the mother is prepared to take the trouble to carry out the treatment properly. In boys it is as well to clip the hair quite short. Combing the hair with a comb dipped in ordinary household vinegar or any weak solution of acetic acid will also help to remove the nits, and if preferred the acetic acid and mercuric perchloride can be put into one lotion and scrubbed in, but the writer has usually found that the ordinary out-patient mother thinks more of an ointment than a lotion and will generally apply it more thoroughly. It should be remembered that the question of removing the nits is not so important as is generally supposed as the eggs hatch out on the sixth day after they are laid, and the white nits on which so much energy is frequently expended are only empty egg-shells and therefore harmless; before hatching the nits are black. There is no advantage in using strong smelling applications such as Sassafras Oil, although of course the condition can be cured by their means. Paraffin compounds are satisfactory from the therapeutic point of view, but owing to their inflammable nature are dangerous in the hands of out-patients.

Pediculosis Corporis.—In the treatment of this condition the most important point is the disinfection of the clothes, as the pediculi lurk specially in the folds of the shirt or vest around the yoke and shoulders; the disinfection is best carried out by either baking or boiling. The mercurial ointments are all quite satisfactory applications for this condition, and the writer generally uses Ung. Hydrarg. Ammon. as for pediculosis capitis. Sulphur ointment is also useful sometimes, but as a rule is more irritating to elderly people who are more particularly prone to this parasite. In dealing with an outbreak in institutions such as workhouses, it will often be found extremely difficult to cure some of the aged inmates; the important point, under these conditions, is to treat at the same time all those infected and thoroughly to disinfect all the clothes.

Pediculosis Pubis.—For this condition the patient should take a hot bath and lather well with soft soap; after the bath a disinfectant ointment such as Ung. Hydrarg. Oleat. (B.P. strength) should be well rubbed in. The ordinary grey ointment or Ung. Hydrarg. diluted with an equal amount of Benzoated Lard is also a satisfactory application, and some patients find β-napthol ointment less irritating than the above. It should be remembered that this parasite spreads into other parts of the body, and it is important to eradicate it everywhere at once; it is never necessary to shave the affected areas. The disinfection of the clothes is not so important in this condition as in the one above. As a rule a complete cure is produced after two good rubbings.

WILFRID S. FOX.

ACUTE PEMPHIGUS.

In adults this is a microbic affection, which is best treated by systemic tonics, arsenic, quinine and strychnine being most commonly employed. Locally soothing and mildly antiseptic lotions or ointments are to be used. Pernet[1] has recorded a cure in a severe case. He used 1 in 60 carbolic oil locally, and internally administered arsenic, with the addition of opium for diarrhœa.

Gaucher[2] advises dusting with aseptic dusting-powders or covering with carbolised (1 in 200) linimentum calcis. In malignant types he recommends large doses of sulphate of quinine.

If the organism can be found, and many have been described, it would be advisable to try a vaccine in a bad case.

In children (pemphigus neonatorum) we probably either have to deal with a septic infection allied to impetigo contagiosa or a bullous eruption due to syphilis, although some maintain that it is a distinct disease. One must first, therefore, eliminate syphilis or treat it and then use starch or boracic baths, and the continual application of an ointment, such as the following: ℞. Hydrarg. Ammoniat. vel Bismuth. Subnitratis, gr. 5 to 10; Paraffini Mollis Albi, ℥j.

F. GARDINER.

References.

[1] Brit. Journ. of Dermatol., 1910, XXII., pp. 1—5.
[2] "Diseases of the Skin," transl. Lond., 1910.

CHRONIC PEMPHIGUS.

The first point that one would like to emphasise in this condition is that one must be absolutely certain that it is a real pemphigus that we have to deal with. The disease is extremely rare, and in ninety-nine out of one hundred cases diagnosed it is found to be an error; hence the reputed cures by various remedies. Arsenic is probably our only remedy, and it often fails. A change to the country and usual hygienic and dietetic measures to build up the patient's system are of great value, but recurrences are common, and, in the old and feeble especially, the prognosis is of the gravest.

Locally, measures of a soothing type, as prescribed under Acute Pemphigus, should be used.

F. GARDINER.

PEMPHIGUS FOLIACEUS.

For this form of bullous eruption, as obscure in its etiology as its allies, there is no real remedy. Sometimes the patients cannot stand a bath; but, if they can do so, boracic, starch or permanganate of potash baths are very valuable in keeping down the sepsis and its resultant odour.

Owing to the widespread character of the disease the patient is generally very debilitated and confined to bed, and then we may have to be content with sponging.

Drugs are of no permanent value, but quinine seems to have most effect. Vaccines of staphylococci at times appear to allay the pustulation, but they also do not strike at the root of the disease.

Plain vaseline, or this with the addition of bismuth oxychloride (10 gr. to 1 oz.), should be kept continually on the skin.

Other remedies, such as a very weak tar, may be tried for the severe itching, but I have never seen any do good.

F. GARDINER.

PEMPHIGUS VEGETANS.

This disease is generally fatal, but cures have been recorded, such as the one recently described by Fox.[1] This yielded to increasing doses of Fowler's solution and iodide of sodium; locally, dusting-powders, zinc ointment and vaseline were used.

Some authorities have recommended scraping under an anæsthetic and then painting on iodine tincture, but the measures used in other forms of pemphigus are just as useful.

F. GARDINER.

Reference.

[1] Brit. Journ. Dermatol., 1908, XX., pp. 181—89.

PITYRIASIS ROSEA.

The exact cause of this somewhat rare skin affection is unknown. The course of the disease with its herald patch, general symptoms and widely distributed eruption like an exanthem shows a certain parallelism with syphilis, and suggests the possibility that the disease is of microbic origin. This view is further strengthened by the fact that several cases have been known to occur at the same time in one family, and that it not infrequently appears in epidemic form. Still, no definite instance of contagion is at present known, and no specific micro-organism has been established in connection with it. The prognosis is, as a rule, excellent, as the disease tends to disappear spontaneously in six to eight weeks. Its progress may be considerably hastened, however, by suitable treatment, and the patient may at the same time be relieved from more or less distressing symptoms, such as irritation and pruritus. In a few rare cases it has been known to continue for several months in spite of treatment.

General Treatment.—On the assumption that the disease is due to the circulation of some microbe or toxin in the blood, certain antitoxic internal remedies such as quinine, salol, salicin and beta-naphthol may be prescribed, and they all have their advocates. Of these salicin is possibly the most useful, and should be given in doses of 10 to 15 gr. three times a day. At the same time any obvious defects in the general health, such as rheumatism, digestive disturbances and constipation, should be corrected by suitable means.

Local Treatment.—With regard to the local treatment, considerable caution should be exercised in the choice of a remedy, for in a disease which clears up spontaneously in a comparatively short time it is unwise to run the risk of aggravating the condition, which may be easily done, by unsuitable local treatment. The injudicious employment of sulphur baths, strong sulphur ointments, and other irritating local applications may readily aggravate the disease, increase the pruritus, and even transform the lesions into eczematous patches or produce a generalised dermatitis. The treatment should consist of a daily warm alkaline bath containing borax (2 oz.) and sod. bicarb. (2 oz.) to the 30 gallons, in which the patient should remain for twenty minutes, during which time the skin should be rubbed with a non-irritating soap or with green soap. Instead of the alkaline bath Jamieson recommends a permanganate of potash bath containing a few teaspoonfuls of Condy's fluid. After drying, one or other of the following creams should be rubbed into the skin : ℞. Acid. Carbolic. ♏5 ; Calamin. Prep., gr. 15 ; Zinci Oxidi, gr. 15 ; Liq. Calcis, ℥ss ; Ol. Amygd., ℥ss ; or ℞. Resorcin., gr. 15 ; Glycerini Amyli, ʒij ; Paraffinum Molle Album, ad ℥j.

After the cream has been well rubbed in, the skin should be dusted over with the following powder : ℞. Acid. Salicylic. gr. 10 ; Zinci Oxidi, ℥ss ; Talc, ℥ss.

When resistant patches are present they should be rubbed with an ointment such as the following : ℞. Sulphur. Præcip., gr. 15 ; Acid. Salicylic., gr. 10 ; Paraffinum Molle Album, ad ℥j.

The pruritus associated with the affection is in some cases so intense as to require special treatment. In such cases the skin may be dabbed over with the following lotion : Liq. Carbonis Deterg., ℥ijss ; Liq. Plumbi Subacetatis, ℥j. For use, a teaspoonful should be added to ½ pint of tepid water.

The following lotion may also be employed : ℞. Calamin. Prep., gr. 15 ; Zinci Oxidi, gr. 10 ; Glycerini, ♏30 ; Liq. Carbonis Deterg., ♏10 ; Liq. Calcis, ʒj ; Aquam, ad ℥j. This should be pressed into the skin with a piece of cotton-wool, and then allowed to dry in. During the treatment the patient should wear non-irritating underclothing, such as silk and cotton, rather than wool. After a week or ten days' treatment marked improvement generally results, but not infrequently the alkaline baths and the various local applications render the skin uncomfortably dry, in which case it should be anointed, after an ordinary warm bath, with cold cream or almond oil.

J. M. H. MACLEOD.

PITYRIASIS RUBRA PILARIS.

Generally occurring amongst individuals who are in a weak state of health, this rare disease is not very amenable to treatment. Arsenic is not considered to be of much value, but recently I had a case in a boy in which this remedy was of great use. Another case in a girl treated in the skin department of the Royal Infirmary did very well with injections of ⅓ gramme of soamin about once a fortnight.

The state of the patient mostly indicates the giving of tonics, such as cod-liver oil and iron.

Starch or alkaline baths do good by removing the scales and softening down the hyperkeratosis.

A 2½ per cent. salicylic vaseline is, I consider, the best ointment for external use, although some advise weak tar or resorcin.

Gaucher[1] recommends glycerine of starch, with 5 per cent. of tartaric acid or oil of cade.

Itching is sometimes very troublesome, and if external remedies do not alleviate, then 5 to 30 min. [U.S.P. 3 to 15 min.] of tinct. cannabis indicæ may be given internally, as suggested by Crocker.

F. GARDINER.

Reference.

[1] "Diseases of the Skin," trans. Lond. 1910.

PITYRIASIS RUBRA.

Pityriasis Rubra in infants is a remarkably fatal disease, allied to impetigo contagiosa, therefore due probably to a streptococcus. It must be treated by giving the child the best of nourishment, keeping it at a uniform temperature and applying some mild antiseptic ointment. In very urgent cases the use of antistreptococcus serum might well be tried.

When dealing with cases in adults the best drug internally, in my opinion, is quinine, and it must be pushed to the limits of tolerance. Jackson[1] and Hyde, in America, both speak highly of it, the latter giving up to 60 gr. per diem. Mook[2] reported six severe cases in which he had splendid results, administering as much as 85 gr. in two hours, and only diminishing the dose when the ringing in the ears was very bad.

Alcohol is interdicted because of its effect in causing flushing of the skin ; but in some cases, where there was extreme collapse, I have used it with benefit. Much better in these cases, however, is digitalis or strychnine hypodermically.

Owing to the vasomotor dilatation there is often great weakness, and in addition to the cardiac failure one has to guard against chills and resultant pneumonia.

Primary cases are often traceable to some toxic condition, and accordingly carbolic acid is recommended for internal use.

Cases secondary to psoriasis or lichen, etc., although attributable undoubtedly sometimes to the use of too irritant remedies, are in others due, I am sure, to septic infection, and if this is so precautions against this should be taken in all widespread cases.

Other internal drugs suggested are diuretics and salines to relieve the strain on the skin as an excretory organ. Antimony is highly praised by Jamieson[3]; but I doubt its value, as the pulse is generally soft enough. Diet, of course, should be light, and mostly milk.

The fundamental rule for external treatment is that it should be soothing. Many cases do well on simple vaseline, or this with the addition of 10 gr. of bismuth oxychloride to 1 oz.

Starch baths are of most value, but Whitfield[4] recommends 2 drachms of potass. sulphurat. in a 30-gallon bath.

Gaucher[5] advises the use of linimentum calcis externally, starch baths, and if the itching is pronounced 1 per cent. of menthol or camphor in ointment.

A good percentage of the cases die, and recurrences are common.

As a case secondary to such a condition as psoriasis recovers, the old eruption generally reappears, and this has to be treated by such remedies as very weak tar or oil of cade, starting, say, with a 1 per cent. ointment and increasing the strength.

F. GARDINER.

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[1] Jackson, Amer. Journal of Cutaneous Dis., 1909.
[2] Mook, W. H., Journ. Cutan. Dis. Med. Syph., New York, 1908, XXVI., pp. 408--15.
[3] Jamieson, W. A., "Diseases of the Skin," 4th edit., Edin. and Lond., 1894.
[4] Whitfield, A., "Skin Diseases and their Treatment," 1907.
[5] Gaucher, E., "Diseases of the Skin," trans. Lond., 1910.

PITYRIASIS VERSICOLOR.

Pityriasis Versicolor is as a rule very easily removed, but recurrence is somewhat persistent, especially at the beginning of the hot weather and in the tropics. As a rule two or three applications of almost any disinfectant ointment will remove all visible traces, but unless the clothes are thoroughly disinfected the disease will almost certainly recur. The skin should be washed well with soap and water to remove the top layers and also the natural grease, and then a disinfectant ointment, preferably of mercury or sulphur, should be well rubbed in twice daily. Unguentum hydrarg. ammon. or the precipitated sulphur and potassium carbonate ointment, as used for scabies, are the most satisfactory. Cinnabar and Sulphur mixed as follows—Hydrarg. Sulphidi Rub., gr. 10; Sulph. Precip., gr. 15; Adipis Benzoat. ad ℥j—form a very satisfactory ointment. Each day clean underclothing must be put on and also clean pyjamas or night-wear, and those taken off should be either baked or boiled. This treatment continued for four days is generally sufficient to completely eradicate the disease.

Pityriasis Nigra is simply a variety of the above, which is sometimes seen in tropical countries.

WILFRID S. FOX.

PRURIGO.

It is in patients who are manifestly in a poor state of health that we find this disease in its worst phases, and accordingly one's first aim is the attainment of a more robust constitution.

Cod-liver oil and iron, along with generous diet, are the lines most uniformly successful. Fats should be freely given, but meat should be diminished, if not absolutely stopped.

The itching is often so great as to affect sleep, and this in turn affecting general nutrition and that of the skin, the disease goes from bad to worse, so that tinct. cannabis indicæ, bromides or belladonna have often to be used.

Locally, simple inunction with cod-liver or carron oil or vaseline gives the best results. Whitfield[1] points out that when an affected limb is freed from irritation by being swathed in cotton-wool it gets practically all right. To allay the itching a simple ointment (containing 2½ per cent. of sulphur or beta-naphthol) is extremely valuable. If, however, there is much secondary infection by surface organisms, this had better be preceded by inunction of vaseline, containing 5 gr. of hydrarg. ammoniati to 1 oz.

Later stages of thickening may be treated by salicylic ointment or even crude tar.

Baths must be used regularly to increase the action of the glands of the skin, and this may be further increased by the injection of pilocarpin. This drug must, of course, be used with caution, the patient being swathed in blankets and carefully dried after the excessive perspiration to avoid chill. It seems also to allay the itching, and I have seen it followed by good results.

F. GARDINER.

REFERENCE.

[1] "Skin Dis. and their Treatment," 1910.

PRURITUS OR ITCHING.

The successful treatment of pruritus consists not only in the alleviation of the itching, but in the recognition and elimination of its cause, and consequently it varies indefinitely in different cases.

General Remarks.—As a prelude to the treatment it is essential in every case of pruritus to make a thorough examination of the skin to detect the presence of any cutaneous disease or local irritant which might be responsible for it. Should the result of the search be positive, the treatment then resolves itself into that suitable for the underlying skin affection. In the event of there being no evidence of cutaneous disease or local irritation, a careful physical examination should be made, special attention being directed to the examination of the digestive, nervous and genito-urinary systems. Any defect of health should be combated by suitable remedies; indigestion and constipation should be treated on general medical principles; toxins absorbed from the lower part of the alimentary tract, which are a not infrequent cause, should be counteracted, or removed by small doses of calomel at night, followed by a saline draught in the morning, by lactic acid (5 to 10 min.) thrice daily, or by a course of soured milk properly prepared from a ferment containing the true Bulgarian bacillus. Disorders of the liver, with or without jaundice, must be treated. The urine should be examined for sugar or albumen, and a careful examination should also be made of the blood, as pruritus is a symptom associated with diabetes, Bright's disease, lymphadenoma and chlorosis. The nervous system should also be examined. Apart from definite nervous lesions, the sufferer from generalised pruritus is frequently neurasthenic, irritable and depressed, and may require a proper tonic *régime*, in which change of air and a healthy, outdoor life are specially valuable.

The diet in cases of pruritus should be simple and nutritious; alcohol in all its forms should be given up, and coffee forbidden; meat should only be taken once a day, and in some patients relief is obtained by resorting to a purely vegetarian diet. Considerable benefit may be derived from flushing out the system by copious draughts of slightly alkaline mineral waters, or by a sojourn to some suitable spa, such as Harrogate, Buxton, or Carlsbad. The underclothing should consist of silk, silk and cotton, or linen, and woollen garments or flannel with a hairy surface should not be worn next to the skin. The bedroom should be kept at a cool, even temperature, and the bedclothes should be light, and may, with advantage, be raised off the patient by means of a cradle.

Internal Treatment.—There cannot be said to be any internal specific against pruritus, though a large number of drugs have been recommended for the purpose. Of these the most commonly employed are valerian, carbolic acid, atropine and arsenic. Valerian may be prescribed in the form of a tincture, in doses of 1 drachm three times a day; carbolic acid in pill form, or in a mixture containing 2 gr. to the dose; atropine, in the form of the liquor atropinæ sulphatis (1 to 2 min.); [U.S.P. atropinæ sulphatis, gr. $\frac{1}{110}$ to $\frac{1}{55}$] and arsenic, in doses of 2 to 8 min. of the liquor arsenicalis [U.S.P. liquor potassii arsenitis]. Of these probably the best is valerian, but they are all uncertain, and may do more harm than good. Nerve sedatives and analgesics have been more or less extensively used, such as sulphonal, chloral hydrate, the bromides and antipyrin. Although these drugs all ease the pruritus temporarily, they are depressing in their action, and when their effect wears off the patient is less able to bear the pruritus should it return; hence they should always be prescribed with the utmost caution, and should be reserved for cases where insomnia is a marked feature. Opium in any form should not be given, as it may itself produce pruritus, and has the same depressing effect as the others. On the whole, more reliance should be placed on internal treatment carried out on general principles than on any so-called internal specific.

The local treatment of pruritus may be considered under the headings of chemical and physical methods.

Chemical Remedies.—There is a vast number of chemical anti-pruritic remedies, of which the most serviceable are menthol, carbolic acid, alcohol, opium, tar and lead. The choice and mode of application of these is determined by the degree and extent of the pruritus. *When it is extensive* the most useful method of application of the above remedies is in the form of lotions, creams or dusting powders.

1. Lotions.—The following formulæ will be found to be useful:

Carbolic Acid may be employed in the strength of 1 in 40, or in a calamine lotion: Carbolic Acid, ʒj; Zinc Oxide, ʒiij; Prepared Calamine, ʒj; Glycerine, ʒiij; Lime Water, ℥j; Rose Water, ℥iv.

Alcohol.—The alcoholic lotions act in virtue of their power of evaporating quickly. Of these eau de Cologne and rectified spirit, either undiluted or diluted with various percentages of water, may be employed.

Tar.—The simplest tar lotion consists of a teaspoonful of the liquor picis carbonis, or the liquor carbonis detergens to a pint of water, the strength to be gradually increased according to the toleration of the patient.

Lead may be employed in the form of the liquor plumbi subacetatis, a teaspoonful to a pint of water, with or without the addition of an ounce of glycerine. It may also be combined with tar, as in the following lotion: Liquor Plumbi Subacetatis, ℥ss; Liquor Carbonis Detergens, ℥ijss. A teaspoonful to be added to ½ a pint of tepid water.

Opium is also a valuable anti-pruritic remedy, and may be employed in the following lotions: ℞. Extract of Opium, ♏5; Hot Water, ℥j. ℞. Tincture of Opium, ♏15; Camphor, gr. 30; Almond Oil, ad ℥j [U.S.P. Tincture of Opium, ♏9; Camphor, gr. 30; Almond Oil, ad ℥j].

Alkaline Lotions, consisting of borax or bicarbonate of soda (10 to 15 gr. to the ounce), are valuable when large areas are affected.

Ichthyol also has an anti-pruritic action, and may be employed in a lotion consisting of 1 to 4 per cent. in water or spirit, its value being enhanced by the fact that it tends to dry on the skin in the form of a film. The anti-pruritic action of these lotions may be intensified by the addition of menthol, dilute hydrocyanic acid or cocaine (2 per cent.). It is necessary to have a considerable number of anti-pruritic lotions at one's disposal, as toleration to an individual remedy is readily established, and applications which will suit one case may be ineffective in another. The lotions should be applied by means of a single layer of lint saturated with them, laid over the affected surface, and kept moist by spraying or pouring on a little more of the lotion every few minutes.

2. Creams.—By applying remedies in the form of creams the effect is more lasting than if they are employed as lotions. The simplest base for a cream is olive oil, to which may be added 1 to 2 per cent. of carbolic acid, menthol or ichthyol. A useful base is that known as cremor calaminæ, containing a drachm each of prepared calamine and zinc oxide to an ounce of carron oil.

3. Powders have a cooling effect on the skin by absorbing moisture and at the same time protect it from the atmosphere and friction. The most useful dusting powders contain as bases oxide of zinc, magnesium carbonate, bismuth subnitrate and starch, and to these or to any combination of them may be added 10 per cent. of camphor, which is definitely anti-pruritic. Care should be taken

in the preparation of them that they are powdered down as finely as possible. The different natural earths which have been much advertised are also useful, but it is necessary to be careful that they have been properly sterilised in case they should contain tetanus bacilli.

When the pruritus is localised to one or more patches a more lasting effect may be obtained by applying remedies in the form of *ointments, pastes,* or *varnishes.* The anti-pruritic external remedies mentioned above may all be used in this fashion, and to those may be added others, such as chloral hydrate, conium and cannabis indica. One of the best bases for an anti-pruritic ointment is a well-made cold cream, of which useful formulæ are: ℞. Lanolin, ʒj; White Wax, ʒj; Almond Oil, ℥j; Rose Water, ℥j. ℞. Lanolin, ʒij; Benzoated Lard, ʒiv; Rose Water, ʒvj. To an ounce of either of these creams may be added: Menthol, gr. 5; Hydrochlorate of Cocaine, gr. 10; Extract of Indian Hemp, ʒss; Extract of Conium, ʒj, or Chloral Hydrate ʒj. To stiffen the ointment 1 or 2 drachms of zinc oxide may be added. Occasionally it is an advantage in situations exposed to friction to employ instead of the cold cream base a paste such as that suggested by Lassar, containing equal parts of zinc oxide, starch, lanolin and soft paraffin.

When the pruritic areas are small, varnishes and gelatines are particularly serviceable. As an example of a useful base for a varnish Klingmüller suggested the following: Zinc Oxide, ʒij; Glycerine, ʒij; Starch, ʒij; Rectified Spirit, ℥ss; Water, ℥ss. To this may be added ichthyol or balsam of Peru (2 per cent.). An excellent gelatine base is that of Unna: Gelatine, ʒij; Glycerine, ʒiv; Zinc Oxide, ʒiij; Water, ℥j. The gelatine is melted in the water, the glycerine and zinc are rubbed up together in a mortar, and the various constituents are incorporated in a water bath. This sets on cooling and requires to be melted before being applied. It should be painted on with a brush and allowed to dry over the skin like a piece of kid glove. To it may be added ichthyol or sulphur (1 to 2 per cent.).

Physical Methods.—*Hydrotherapy.* When the itching is localised the application of a sponge wrung out of as hot water as can be borne gives temporary relief. Hot baths and Turkish or vapour baths may stop the itching, and act by causing a dilatation of the skin capillaries, followed by a constriction. Benefit may be obtained by the addition to a hot bath of bran, oatmeal or linseed meal (2 lb.), carbonate of soda or borax (2 oz.), gelatine (¼ lb.), or starch (1 lb.) to the 30 gallons of water. These are not invariably successful, and in some cases do actual harm by being followed by an exacerbation of the itching. Tepid douches or sprays applied along the vertebral column for five to fifteen minutes daily are worthy of a trial. Cold water, either in the form of whole or partial baths, is liable to do more harm than good. Benefit may be occasionally derived from the employment of cold compresses or cold sprays or douches, especially when followed by the application of an evaporating alcoholic lotion or a dusting powder.

Electrical Methods.—In cases of localised pruritus a certain amount of relief may be obtained from the brush discharges from a high-frequency apparatus, and from faradisation in the form of a faradic brush or a faradic bath. The judicious application of the X-rays is of far greater value than either of these, about half of a Sabouraud pastille dose being given, and repeated the following day if necessary.

I. M. H. MACLEOD.

PRURITUS ANI.

Pruritus Ani is a symptom and not a disease. It is dependent chiefly on local causes, the removal of which, as a rule, effect a cure; but it may occur in association with constitutional derangements, and the most careful search may fail to reveal any local condition which might be responsible for it. For example, it may be caused by disorders of the alimentary tract, especially constipation, derangements of the liver, impaired digestion brought about by rich indigestible foods, indulgence in alcohol and coffee, or it may be a symptom of diabetes, gout and rheumatism. It is much more frequently the result, however, of local conditions, of which the most common are affections of the rectum, such as catarrh with an offensive discharge due to chronic proctitis, or the presence of threadworms or masses of hard dry fæces and lesions in the mucosa, such as small polypi, collections of irritating matter, and ulcers or fistulous openings in the anal pockets. It may also be caused by hæmorrhoids and not infrequently by small superficial ulcers or cracks situated between the sphincters. Other important causes are imperfect cleanliness about the anus, and incomplete emptying of the sigmoid flexure and rectum resulting from the unnatural position usually adopted in defæcation necessitated by the ordinary seats in water-closets.

Disease of the genitalia, such as gonorrhœa and leucorrhœa, and disorders of the bladder and uterus are liable to cause pruritus ani, either directly or reflexly. Tumours in the rectum or pelvis by obstructing the venous circulation may also be responsible for it. Skin affections beginning near or encroaching upon the anus, such as boils, eczema and psoriasis, are apt to be associated with it.

Most cases are curable if treated early, and provided that the cause is discovered and removed. Should, however, the treatment be delayed until the skin has become indurated or eczematised from scratching or rubbing, the itching may persist in spite of the removal of the cause. In every case as a preliminary to treatment the anal region and the rectum should be properly examined for hæmorrhoids, blind fistulæ, polypi or other possible local causes. One of the most important preventive measures is scrupulous cleanliness after defæcation, and instead of using paper a pad of cotton-wool moistened in water should be employed, and the part then dabbed dry and a simple dusting powder applied. Constipation, which is one of the most important causes, should be treated on general principles. Alcohol and coffee should be avoided, and excessive smoking forbidden. In cases where there is marked neurosis, outdoor exercise should be encouraged, horse-riding and cycling being of special value.

Local Treatment.—Any local lesion present about the rectum must be suitably dealt with. Catarrh should be treated by washing out the rectum with weak antiseptic lotions, hæmorrhoids removed, small redundant tags of mucous membrane snipped off, and ulcers and fissures destroyed by silver nitrate or the thermo-cautery.

If the skin about the anus is thickened, this should be dealt with by painting the part with 95 per cent. carbolic acid, which causes the epidermis to peel, leaving a tender surface to which zinc oxide should be applied, or the part may be ironed with the actual cautery at a dull red heat, a painful procedure requiring an anæsthetic. Of more value than either of these means are applications of the X-rays, a full Sabouraud dose being given, and repeated if necessary in a month. Radium has also been found to be of value in these cases. In obstinate cases incision of the thickened peri-anal skin has been suggested, after which the surrounding skin is undermined, drawn over the denuded surface, and stitched to the rectal mucosa.

There is a considerable number of cases, however, in which no definite lesion can be detected in the anal canal or rectum, and in these cases the employment of some local application to relieve the itching is demanded. The number of remedies which have been recommended for this purpose is almost indefinite. In every instance it is advisable to begin the local treatment cautiously, with bland applications, rather than risk employing stronger remedies, which might prove irritating. Lassar's paste, containing equal parts of zinc oxide, starch, lanolin or soft paraffin with or without the addition of salicylic acid (2 per cent.), is an admirable application in mild degrees of pruritus ani, as it not only relieves the itching, but by forming a thick coating about the anal orifice protects the parts from friction and scratching. The most useful anti-pruritic remedies for this affection are carbolic acid, menthol, ichthyol, chloroform, tar and belladonna.

Carbolic acid may be prescribed in olive oil, glycerine or vaseline (in the strength of 1 to 20). Its anti-pruritic action may be augmented by being combined with sodium hyposulphite, as in the following lotion: Carbolic Acid, ♏10; Sodium Hyposulphite, ʒij; Glycerine, ʒij; Water, ad ℥j.

Cocaine may be used as a lotion or ointment in the following formulæ: ℞. Hydrochlorate of Cocaine, ʒj; Cherry Laurel Water, ℥ij; Rose Water, ℥vj; ℞. Hydrochlorate of Cocaine, ♏15; Zinc Oxide, ʒij; Soft White Paraffin, ad ℥j.

Cocaine may also be applied as a suppository, containing ½ gr. of the hydrochlorate. This gives considerable relief as regards the itching, but in employing it it is important to remember that there is a danger of relieving the pruritus at the expense of establishing a cocaine habit.

Menthol may be applied as a 2 per cent. solution in olive oil, or 50 per cent. alcohol, but its action is more lasting if it is prescribed in the same strength in zinc oxide ointment. As menthol, if persistently used, is liable to inflame the skin, it should only be applied occasionally.

Tar is a valuable remedy for this affection, and may be employed in the form of a liquor carbonis detergens or the liquor picis carbonis, a teaspoonful to ½ pint of tepid water, and the strength increased if desired; or as ointment such as: ℞. Oil of Cade, ʒj; Soft Paraffin, ad ℥j. ℞. Unguenti Picis Liq., ʒijss; Unguenti Belladonnæ, ʒijss; Unguenti Aquæ Rosæ, ʒijss.

Chloroform may be prescribed in the form of an ointment, consisting of chloroform and vaseline, or in the same strength in almond oil.

Mercury is of value when inoculation of pyogenetic microorganisms has taken place from scratching. It may be dusted on as calomel, or applied as black wash diluted with equal parts of limewater, or in the form of an ointment, such as ammoniated mercury gr. 15, and soft paraffin, ℥j.

Ichthyol may be used as a 2 per cent. lotion in water, 50 per cent. alcohol, or in the following ointment: Ichthyol, gr. 15; Zinc Oxide, ʒij; Soft Paraffin, ad ℥j.

Suppositories of cocaine and morphia may be employed and are of great value, especially when the pruritus interferes with sleep, being useful in preventing the scratching which takes place reflexly during sleep, and which may easily undo the benefit derived from the most careful local treatment during the day.

Electrical Treatment.—Various electrical measures have been used for the relief of this affection, with greater or less success. Of these the most important are high-frequency currents, cocaine or zinc ionisation, and the X-rays. Zinc ionisation is of special value when superficial abrasions are present; it consists in applying a piece of lint the size of a penny soaked in 2 per cent. sulphate of zinc to the affected skin. A solid zinc electrode with a rounded surface and a diameter of about an inch is attached to the positive pole of a galvanic battery; the electrode is pressed against the moistened lint, the negative electrode, consisting of a metal cylinder covered with wash-leather and moistened in salt solution, being held by the patient. A current of a few milliampères is then passed for ten minutes. This has a definitely astringent action, causing the superficial abrasions to heal, and sometimes relieving the irritation. Cocaine has also been applied in the same way, the lint being soaked in a 2 per cent. solution of cocaine instead of in zinc sulphate solution. This is said to produce a more marked anæsthetic effect than can be obtained by applying the cocaine in a lotion or an ointment. The X-rays are the most useful of all the electrical methods, and not only possess a definite anti-pruritic action, but at the same time reduce the thickening. (*See also* Diseases of the Rectum, Vol. II.)

J. M. H. MACLEOD.

PRURITUS VULVÆ.

PRURITUS VULVÆ may be due to a number of local causes, such as irritating discharges from the vagina and uterus, smegma collecting about the labia minora, superficial ulcers and tender spots about the inner surfaces of the vulva, parasites such as pediculi pubis, skin affections involving the vulva, such as eczema and furunculosis, urine if irritating from hyperacidity or the presence of sugar, and the venous congestion associated with pregnancy and tumours in the pelvis. In a certain number of cases no definite local lesion can be detected.

The successful treatment of this affection depends on the recognition of the cause and the removal of its effects. When no definite cause can be detected, local anti-pruritic treatment is indicated, combined with general medical treatment to correct any impairment of health with which it may be associated. Should any local cause be noted it must be thoroughly dealt with by suitable means. Small ulcerations should be touched with carbolic acid, silver nitrate or the thermo-cautery; discharges and a catarrhal state of the vagina should be treated by antiseptic douches, and a vaginal tampon inserted to prevent the discharge escaping and irritating the inflamed area; smegma should be removed and scrupulous cleanliness enjoined, and concomitant cutaneous affections, such as eczema and boils, must be treated by appropriate means. When the urine is hyperacid alkalies should be prescribed, and when sugar is present, as in the case of "climacteric diabetes," much benefit can be derived from opium internally in doses of 1 gr. three times a day, with 2 gr. at bedtime. In severe cases of pruritus, especially those occurring in pregnancy, or in which ulcerations, necessitating cauterisation, are present, the patient should be confined to bed until the pruritus has been relieved. What has been said with regard to diet in connection with pruritus in general is equally applicable here. Tonic treatment is indicated in those who are anæmic and run down, and the neurasthenia which so frequently accompanies and intensifies the pruritus should be dealt with by moral persuasion, general massage, and a proper hygienic *régime*. When the itching is so severe as to cause insomnia, sedatives, such as chloral and bromide of sodium, may be resorted to, but the prescribing of these should always be done with caution, in view of the risk of establishing a drug habit.

Local Treatment.—When no definite local cause has been detected, one or other of the various local remedies for pruritus is indicated. Hot water in the form of sitz baths, or applied by a sponge wrung out of as hot water as can be borne, generally gives relief; after the parts have been dried a dusting powder should be applied, and the vulva covered by a pad of cotton-wool fixed by a T-shaped bandage.

A large number of local anti-pruritic remedies have been employed in this condition, such as carbolic acid, menthol, chloroform, tar, chloral and cocaine. Carbolic acid may be prescribed in the form of a lotion, and the following mode of application has been recommended by McCann for severe cases. A number of strips of lint, 3 inches long, are soaked in carbolic lotion (1 in 20) and inserted for an inch into the vagina, and the remainder spread over the labia in such a way that the whole of the pruritic area is covered, a large pad of boric acid wool being then applied over the vulva and fixed with a T-shaped bandage. This may be left on for a whole night, and fresh strips then applied if necessary. In place of the carbolic lotion menthol in a 2 per cent. solution in almond oil may be substituted and dabbed on to the affected parts. When the skin and mucosa are raw and sore, the smarting caused by carbolic and menthol lotions may be so intense that they have to be discontinued and milder methods resorted to. A valuable remedy, when the inflamed spots are few and the affection is confined to the mucosa, is methylene blue, painted on in the form of a 1 per cent. solution. In the treatment of this affection ointments or pastes are more useful than lotions, as they have a beneficial action by protecting the parts from friction and from the action of vaginal discharges. As a base for an ointment equal parts of soft white paraffin and lanolin may be employed, and for a paste equal parts of zinc oxide, starch, lanolin and soft paraffin. Another useful base, especially when the skin is being irritated by sugar in the urine or discharges from the vagina, is the B.P. Codex casein pigment, which is in the form of a thick white emulsion, and forms a protective coating or varnish, which is porous, elastic, and dries on the skin. The formula for this is: Casein, ʒj; Potassium Carbonate, gr. 3; Glycerine, ʒss; Soft Paraffin, ʒjss; Zinc Oxide, gr. 3; Carbolic Acid, ♏3; Distilled Water, ʒiv.

The zinc paste, which forms a more comforting base than the vaseline or lanolin, is especially valuable when the parts have become œdematous or eczematised. To the ounce of one of these bases may be added 2 per cent. of carbolic acid or menthol, or 3 per cent. of ichthyol, hydrochlorate of cocaine, or ammoniated mercury. Other ointments also give relief, such as chloroform ointment, consisting of chloroform and soft paraffin, and tar ointment, such as: Oil of Cade, ʒj; Soft Paraffin, to ℥j; or, ℞. Liquor. Picis Carbonis, ♏15; Zinc Oxide, ʒij; Paraffinum Molle, ad ℥j.

For some time after the pruritus has subsided it is advisable to apply a perfectly bland ointment as a protective against friction, such, for example, as the zinc starch paste.

In cases where the mucosa and skin is thickened, it is necessary to reduce the induration in order to get rid of the pruritus. This may be done by smearing the thickened patches with pure carbolic acid once or twice a week after drying the surface with a piece of cotton-wool, or by the thermo-cautery. The latter procedure is painful, and necessitates a general anæsthetic. In inveterate cases in elderly people, where leukoplakia is present and a tendency to malignant changes, more radical treatment is advisable, and the affected skin and mucosa should be excised and the edges brought together and sutured.

As in pruritus ani, the X-rays are a valuable means of treatment, and thickened patches, associated with much itching, respond well to them. A Sabouraud pastille dose should be given, and repeated in a month or six weeks if necessary. This not only reduces the thickening, but has a marked anti-pruritic action. Radium has also given good results in this affection, in short exposures with a flat apparatus on consecutive days (Wickham and Degrais). (*See also* Diseases of the Vulva, Vol. IV.)

J. M. H. MACLEOD.

PSORIASIS.

General Remarks.—The true nature of psoriasis still remains unknown, notwithstanding the endless researches, clinical, microscopical, chemical and bacteriological, which have been carried out on this common disease from the time of Hebra down to the present day. Successive generations of dermatologists in different countries have favoured this or that explanation of its etiology. By some it has been regarded as an evidence of a peculiar diathesis, and in some vague way connected with a diseased state of the blood; by others it is believed to be of nervous origin and an angioneurosis; while not a few consider it to be parasitic, and due to a microbe either inoculated locally or reaching the skin by the blood stream. Though a certain number of facts have been cited in favour of these different theories by their respective advocates, none of them has been definitely established. It is generally conceded, however, that psoriasis is not a contagious disease, that social position or general health seem to have little or no bearing on its etiology, and that heredity plays some part in its causation, possibly by establishing a predisposition somewhat analogous to that which occurs in tuberculosis. As a result of the uncertainty connected with its etiology the internal treatment is based rather on general principles than on specific lines.

The *prognosis* varies so greatly in different cases that it is practically impossible when a case appears to form any idea of what course it will take; nor is the general state of health of the patient any aid to forecasting the severity of the attack, for in weakly, debilitated patients the attack may be mild and localised in one case and extensive in another, and the same variability in severity may occur in those in robust health. The disease does not, as a rule, tend to involute spontaneously, though it may do so, and if left alone it is apt to be steadily progressive. The duration of the eruption depends on the thoroughness of the treatment; but it may be said that any attack, however severe, may be cleared up in about a month. It is in the nature of the disease to recur; in some cases the attacks are practically continuous, in others recurrences take place at intervals of six months to several years, occasionally it may remain away for many years. By the thorough treatment of each attack, and by a modified local treatment in the intervals between the outbreaks, the extent and severity of the attacks may be gradually reduced, and in some instances the tendency to them may cease finally.

The two great principles of treatment are the elimination of the cause of the disease and the removal of its effects. As has already been stated, the cause of psoriasis still remains unknown, but our clinical and histological knowledge of its effects is sufficient to enable us to treat them in a rational fashion, and with every hope of success. To do this we have to depend to a large extent on local treatment, but this should be combined with a suitable general *régime* as specially indicated by each individual case. But whatever the treatment be it must be thorough and continued till every trace of the affection is removed, otherwise an early recurrence is almost inevitable.

General Management.—When the psoriasis is of an acute and actively spreading type, and is widely disseminated over the skin, one of the most important principles in the general management of the case is *rest*, and, if possible, complete rest in bed. By this means the skin's activity is lessened, much of the irritation from friction and compression to which the skin is subjected when moving about is avoided, tension in the cutaneous blood-vessels is diminished, and local treatment can be more thoroughly carried out. Many cases will almost clear up after a month's rest in bed apart from other treatment. Almost as important as physical rest in the management of acute cases is mental rest: rest from worry, anxiety and overwork. This is one of the greatest difficulties in the treatment of the disease, as it is practically impossible to get rid of a extensive attack so long as the patient is harassed by mental anxie or business worries.

Diet.—A good deal has been written with regard to the food psoriasis, and various articles of diet have been prohibited accordi to the fancy of different physicians. Indulgence in meat has be specially blamed for aggravating the disease, and it has b suggested that a vegetarian diet is an aid to its removal, and m even effect a cure. No one has proved, however, that psoriasis be caused by the eating of meat, and any statements to that e have been somewhat vague, such as that it occurs more freque in those whose urine is excessively acid, and in which the nitroge content is increased as the result of a too generous meat die that it is more common in butchers than in other trades. Of co excessive meat-eating is bad for anyone, but I am not conv that it is specially harmful to psoriatics. Nor does it seem t that any object is gained by a fancifully restricted diet. All essary is plain, simple, nutritious food and the avoidance of ing likely to produce toxic eruptions on the skin, such as s, shell-fish, sardines, pickles, eels, strawberries and the like. ell to remember also that one man's food is another man's ., and to guard against any idiosyncrasy on the part of the t. With regard to condiments, however, it is advisable to eful, and strong coffee should be avoided and tea taken in ation. Alcohol, as a general rule, should not be permitted as es the blood-vessels, increases the heart's action, and tends to rate the disease. Occasionally, under special circumstances the digestion is feeble and the patient fatigued, it may be ted in the form of small quantities of sound spirits in plain neral waters, but ale and acid or sweet wines should be ably prohibited.

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Internal Treatment.—Any definite derangement in the general health must be dealt with on general medical principles, such as disorders of the alimentary tract, derangements of the liver and kidneys, asthmatic attacks, bronchitis and cardiac disease. The association of psoriasis with rheumatism is comparatively frequent, and should be combated by salicin and the salicylates. In the case of nervous or hysterical people with psoriasis it is often an advantage to prescribe a sedative mixture containing valerian or bromide. A useful formula for the bromide mixture, and one which is less depressant than the potassium salt alone, is: Pot. Brom., gr. 5; Sod. Brom., gr. 5; Ammon. Brom., gr. 5; Aq. Menth. Pip., ad ℥ss. Sig.: A tablespoonful to be taken at bedtime.

When there is much tension and irritability of the skin, antimony often gives relief, and may be prescribed in the form of the vinum (5 to 10 min.) twice daily; but, owing to its depressant action, it must not be used for aged or debilitated people.

In a number of cases, however, no definite defect in general health can be detected, and it is customary then to resort to one or other of the so-called internal specifics. There are several drugs which enjoy the reputation of having an internal specific action on psoriasis, and of these the most important are arsenic, thyroid extract, mercury and salicin.

Arsenic.—Until comparatively recently arsenic was almost universally regarded as a specific for psoriasis, and on the strength of this belief it has been prescribed so indiscriminately that much harm has been done by it and its value largely discredited. Its action varies greatly in different cases, and though it may do good in some it is almost impossible to predict beforehand which case will be benefited. In some cases it appears to be so effective that the eruption dies away under it with no local treatment. In others, even after prolonged courses of it—only intermitted when toxic symptoms supervene—it seems to have no definite effect on the disease, and the eruption may even continue to spread in spite of its being pushed to the limit of toleration. It seems to be indicated in early cases without much hyperæmia, when the eruption has reached its height and become stationary, and it is especially valuable in first attacks in children. It should not be prescribed in active, acute and inflammatory cases, and when the eruption is developing it will probably make it come out all the faster. It is of little or no value for chronic patches or for the relief of psoriasis of the nails. It should on no account be given when there is any tendency to gastritis or other derangement of the alimentary tract, as it will irritate the gastro-intestinal mucosa, and so indirectly aggravate the skin affection. It is best to give it in small quantities, well diluted with water, after meals, and to stop it at once if any toxic symptoms supervene, such as dryness of the throat, conjunctivitis, pains in the abdomen, vomiting, diarrhœa and insomnia. In any case, however favourable to its use, its action is slow, taking weeks or months to produce any definite improvement, and if given over a prolonged period it is liable to produce pigmentation of the skin and hyperkeratosis of the palms and soles.

Of the various preparations of arsenic the liq. arsenicalis (Fowler's solution) [U.S.P. liquor potassii arsenitis] is the one most generally employed. Small doses (such as 3 min., t.d.) should be given at first, and increased up to 15 min., t.d., or whatever the limit of toleration may be. The full dose should be continued for several weeks, and when improvement results it should be gradually diminished. The addition of tinct. lupuli (ʒss to each dose) has been suggested for the purpose of favouring the toleration to the drug, but this procedure is not to be commended, as it only masks the toxic symptoms. The liq. arsenicalis has also been given by hypodermic injections of 3 to 5 min., in a few drops of distilled water, daily. This is said to be a more efficacious method of using the drug than by the mouth, and not so liable to produce gastro-intestinal symptoms. Should it be decided to employ hypodermic injections, however, the liq. sodii arsenatis should be substituted, as it is a less irritating preparation, causes little pain when injected, and is more stable in its composition than the liq. arsenicalis, and can be sterilised by boiling. Daily injections of 3 min. should be given at first, and this gradually increased according to the toleration of the patient. In Vienna the favourite method of prescribing the drug was in the form of the Asiatic pill, which contains $\frac{1}{12}$ gr. of arsenious acid with 1 gr. of black pepper. Kaposi used to prescribe one to four of these thrice daily, and continue until the patients had taken five or six hundred of them, only intermitting them when toxic symptoms supervened.

Various organic compounds of arsenic have also been advocated. One of the first of those to be used was cacodylic acid, a combination of arsenic with methyl radicals, and containing 54 per cent. of arsenic. It was given in doses of $1\frac{1}{2}$ gr., t.d.s. The sodium salt, known as cacodylate of sodium, was also extensively employed in France, and given in doses of 1 to 3 gr. by the mouth, or $\frac{1}{5}$ to 1 gr. by hypodermic injection. These doses are apparently very large, as 1 gr. of cacodylate of sodium contains as much arsenic as ʒj of the liquor arsenicalis [U.S.P. liquor potassii arsenitis]. According to Fraser, however, the therapeutic value of this drug has been over-rated, and when taken into the body he considers that it is not dissociated, and passes through without exerting either its toxic or therapeutic action to the full extent.

Recently, the different members of the arylarsonate group, namely, atoxyl, soamin, arsacetin and orsudan, have been employed in the treatment of this disease. They are all given by hypodermic injection, in doses of $\frac{1}{2}$ to 3 gr., dissolved in warm water and injected twice a week. Of these arsacetin and orsudan have the advantage of greater stability than the others, but the relative therapeutic merits of the different members of the group has yet to be decided. They do not, however, appear to give any more certain results than arsenic prescribed in any other form, and as they contain a large percentage of arsenium, they are dangerous to employ indiscriminately, and serious results, such as optic atrophy, have been known to follow their use.

A course of the arsenical waters at La Bourboule, Roncengo and Levico has been recommended for the treatment of this disease, but though these natural springs do contain a percentage of arsenic, it is a small one, and any benefit which may be derived from a sojourn to these spas is probably the result of the copious draughts of the waters, change of climate, and general *régime* rather than the specific action of the small quantity of arsenic.

I have referred to the various methods of administering arsenic somewhat fully because no description of the treatment of the disease can be said to be in any way complete without so doing; but personally I have found the drug so inconsistent in its action that I have begun to lose faith in it, and to wonder whether, in the cases which have seemed to do well under its administration, the improvement did not take place in spite of the arsenic, or as a result of its tonic action on the nervous system, rather than from any specific action of the disease.

Thyroid Extract was introduced some years ago by Byrom Bramwell for the treatment of psoriasis, and since then both it and its derivatives, iodothyrin and thyroidin, have been given extensive trials. The extract is given in doses of 2½ to 5 gr. per diem, and increased up to 10 and 15 gr. Its action is as uncertain as that of arsenic. In some cases a clearance of the eruption has been known to take place in a few weeks under its use without any other treatment; but, as a rule, it does little good, and may do much harm. Unfortunately there are no certain indications of the exact type of case which is likely to be benefited by it, though it is said to be most useful in widely spread cases in which the eruption has ceased to come out further and the condition appears to be stationary. If large doses are being employed, the patient should be kept under close observation in case toxic symptoms, such as tachycardia, should supervene. On no account should it be given in patients over fifty, specially in those with weak hearts, as in elderly people the serious symptoms it may produce more than counteract its doubtful utility.

Salicin and the *salicylates* have been strongly recommended by Crocker as substitutes for arsenic, and especially salicin, as it is less liable to disagree than the sodium salt. Salicin is believed to act as a microbicide, by breaking up into salicylic and carbolic acid. It is said to be most useful in acute and widely spread cases, and when given in full doses (15 to 20 gr.) thrice daily after meals. When depressing symptoms and headache are caused by the drug it may be combined with small doses of nux vomica. While admitting that it is undoubtedly beneficial in cases associated with rheumatic symptoms, my experience of its use has been disappointing, and I am not convinced that it has any action on the disease except as a depressant, acting in much the same way as antimony.

Various *alkalies* have also been employed in the internal treatment, and are undoubtedly useful in gouty and rheumatic subjects. Of these Liq. Potassæ, ♏10, t.d.s.; Acetate of Potash, gr. 10 to 30, t.d.s.; and Iodide of Potassium, in large doses of gr. 20 or 30, t.d.s., have been recommended. Though these large doses of the potassium salt are fairly well tolerated, it is a most uncertain remedy, and has no specific action. Certain other drugs have been recommended, such as mercury, either by the mouth or by intra-muscular injections of the soluble salts, in doses similar to those employed in the treatment of syphilis, and carbolic acid in 1 gr. pills, three to six being taken daily (Kaposi); but these have no claim to specific action.

In conclusion, it may be said that there is no such thing as a specific drug for psoriasis, and that those remedies which have had this reputation have gained it probably from the fact that they were being taken at a time when the disease was fading. At the same time it must be conceded that in certain cases arsenic has a beneficial effect, probably by acting indirectly as a nerve tonic and causing a general improvement in metabolism.

Besides treatment by drugs, *a change of scene and change of air* from a bracing to a milder climate may be of great value in chronic resistant cases. On the other hand, in young patients who are run down, a change to the seaside, with sea-bathing or a sea-voyage, may do them more good than any form of medicinal treatment. In the case of the busy man, it is futile to attempt to cure a widely distributed attack so long as he is attending to his work and harassed by business. To lay up such a person at home where he is in easy reach of his office and the telephone does not help matters, for he is still in touch with his work, and chafes at not being able to attend to it personally. In all such cases a complete change to a Continental spa with its associated *régime* is of the greatest benefit. The chief "cures" for psoriasis are at Aix-les-Bains, where the patients are kept in warm baths for long periods, a type of treatment which is not to be recommended in elderly people, as it may cause fainting; Harrogate, Strathpeffer, Aix-la-Chapelle and Barège, which are beneficial on account of their sulphur baths and waters, and especially valuable in the chronic stages of the disease; and La Bourboule and Levico on account of their arsenical waters.

Local Treatment.—In the general treatment of psoriasis success depends much more on the judicious application of ordinary medical principles than on the slavish employment of any vaunted specific. With regard to the local treatment, on the other hand, we have certain definite indications, for here we are dealing largely with effects which in the light of their histology are capable of being removed by suitable remedies. The successful local treatment of a case depends almost as much on the thoroughness with which the treatment is carried out as on the actual remedies used. When only a few localised patches are present, these can be treated successfully by the patient himself without in any way interfering with his work. When, however, the lesions are more extensive, and occur in situations which are not easily got at, it is necessary that the applications should be made by an attendant, and ambulatory treatment becomes difficult and impossible, and when the disease is widely distributed, not only is an attendant necessary, but it is advisable to confine the patient to bed.

The first indication in the local treatment is the *removal of the scales*. Should the disease be extensive, this can be done best by baths. A daily warm bath at 95° to 100° F., with the addition of ¼ lb. of bicarbonate of soda to the 30 gallons of water, should be given. The patient is immersed in the bath for about twenty minutes, during which time the patches are scrubbed with soft soap, to which 5 per cent. liq. potassæ may be added to make it more alkaline. Should the lesions be unusually indolent, they may be rubbed with pumice stone or sand soap. In very acute inflammatory cases alkaline baths may prove too strong and irritating, and emollient baths containing 2 lb. of starch or bran to the 30 gallons of water may be substituted. When there is marked itching the addition of 1 oz. of the liq. picis carbonis to the bath is soothing; or when the skin is greasy owing to the co-existence of seborrhœa, 1 oz. of potassa sulphurata should be added. After the bath each patch should be rubbed with the following ointment: Acid. Salicylici, gr. 15; Glycerin. Amyli, ʒij; Paraff. Moll. Alb., ad ℥j, or if the lesions are painful, simply with olive oil or vaseline. Other methods have been employed, such as wet packs and Turkish baths; but although by them the scales may be removed, they are not so effective as alkaline baths and soft soap.

When the lesions are few, but of a chronic resistant type with thick adherent scales, more powerful measures must be adopted, such as the application of soft-soap dressings covered by oiled silk. These should remain on for a few hours, after which the lesions should be scrubbed with soft soap and hot water, and then rubbed with 5 per cent. salicylic lotion in alcohol, or with a creolin solution in water, and finally dressed with lint soaked in olive oil continuously applied under oiled silk; or in place of the lotion salicylic soap plaster may be substituted.

For the removal of scales on the *scalp* the following procedure should be adopted. The scalp should be shampooed with soap liniment containing: Saponis Viridis, ℥ij; Spiritus Vini Rect., ℥j. A little of this liniment should be poured into a saucer and rubbed into the scalp by a piece of wet flannel. By parting the hair in different positions the whole of the scalp should be carefully gone over. After the washing and drying is complete the following ointment should be applied: Acid. Salicyl., gr. 15; Hydrag. Ammon. gr. 10; Paraff. Moll. Alb. ad ℥j.

To avoid the ointment soiling the pillow at night a bathing cap may be worn. Should the scales be unusually thick and adherent they may be previously softened with olive oil. This procedure should be repeated as often as necessary. The removal of the scales on the scalp is, of course, greatly facilitated in severe cases by cutting the hair short, but this is not always practicable.

When the scales have been removed, one or other of the so-called *reducing agents* should be employed, with the object of attempting to improve the cornification, and so diminish the tendency to the formation of scales. Of these the most important are chrysarobin and tar, and of less value pyrogallol, naphthol, salicylic acid, resorcin and mercury. These reducing agents are said to act by abstracting oxygen from the tissues. In the choice of the one to be used care and judgment are necessary, for several of them are powerful irritants, and must be used with caution to avoid producing a dermatitis, and they should be employed weak at first, and the strength gradually increased. In psoriasis, as in almost every form of skin disease, each case must be considered and treated on its own merits ; even different patches of psoriasis in the same case may require different treatment. When the patches are few and widely separated from each other, each lesion may be treated separately, and strong remedies employed. On the other hand, when they are close together, and widely distributed over the cutaneous surface, it is practically impossible to treat each lesion by itself, and the ointment or other application, having to be rubbed over large areas, requires to be much weaker.

Should the type of case be unusually irritable and the lesions much inflamed before using any of these reducing agents, it is necessary to reduce the inflammation. This may be done by dressing the parts continually under waterproof with lint soaked in a solution of glycerinum plumbi subacetatis (1 in 8) [U.S.P. Plumbi Acetatis, 15·00 ; Plumbi Oxidi, 10·50 ; Glycerini, 60·00 ; Aquæ Destillatæ, 36·00], or applying calamine cream. It must be understood, however, that the action of the reducing agents is always an irritative one, and that their relative value in a cure of a case may be said to be directly dependent on the degree of inflammatory action which they excite.

Chrysarobin is the most powerful of the reducing agents, and requires to be employed with caution, as when used on an irritable skin, or on individuals with an idiosyncrasy to it, it is capable of causing serious inflammation, and may transform psoriasis into an exfoliative dermatitis. Great care must also be exercised to prevent it reaching the eyes, as it is liable to cause a severe conjunctivitis;

consequently it is better not to employ it about the face or scalp. When used too extensively it may be absorbed, and cause toxic symptoms, such as pain, fever and insomnia. Another disadvantage connected with it is that it stains the hair yellow, the skin a brownish purple, and the clothing a dirty yellow colour, which is turned by the alkali of soap in washing into an indelible purple. In consequence of these peculiarities it is inadvisable to trust the remedy into the hands of any but the most careful patient, and it is better to restrict its use for cases which are being treated under close medical supervision.

The chief value of the remedy is the powerful inflammatory action which it excites. This causes a dilatation of the blood-vessels in the skin around the patch before those of the patch itself are affected, so that at one stage in the treatment the psoriatic lesion appears white in the centre of a purplish-red inflamed area. The treatment should not be stopped here, however, as the whiteness only indicates that the disease is still present, but the applications should be continued till the patch itself is inflamed. Chrysarobin is most suitable in the extensive cases in which there is little inflammation and the disease has reached its height, and in chronic resistant patches. It should not be used in acutely inflamed, actively spreading cases, unless in a weak form, such as 2 per cent. in ungt. zinci oxidi. The procedure in an extensive case is as follows: After the scales have been removed by an alkaline bath and soft soap, a 6 per cent. ointment in vaseline is rubbed into the affected skin by a piece of flannel, or applied by a stencil brush to avoid staining the fingers. The same ointment is also spread on lint and the lesions dressed with it once a day under a bandage or a binder, a linen mask being worn except at meals to avoid irritating the face. As the ointment is apt to irritate the thin skin about the flexures of the groins, axillæ, and popliteal spaces, and as the lesions are seldom present there, Norman Walker recommends that these patches should be previously rubbed with a zinc paste. In six or seven days the patches generally become blanched and surrounded by an inflamed area, and a few days later the patches themselves become inflamed. For the next day or two the chrysarobin ointment should be discontinued and calamine cream applied to soothe the skin. The skin, as a rule, is now found to be cleared of the lesions, with the exception of a few resistant patches usually situated about the extensor aspects of the limbs. These should be specially treated by a stronger ointment containing: ℞. Acid. Salicylic., gr. 20; Chrysarobin., ʒss; Sapon. Viridis, ʒiij; Paraffinum Molle, ad ℥j.

During the treatment it is necessary to watch the skin most carefully, and to stop or weaken the ointment and apply a sedative cream should any severe inflammation be produced. In the case of localised patches stronger chrysarobin ointment may be employed up to 10 per cent., but at first even with these patches the drug should be used cautiously till the degree of toleration of the individual towards it is ascertained. In these cases, instead of using it in ointment form, the chrysarobin may be dissolved in traumaticin (guttapercha, ʒj; chloroform, ℥j), which is painted on with a brush daily for a week, after which the scabs are washed off, and if the lesion has not disappeared the painting is repeated. Instead of the traumaticin it may be dissolved in benzine, painted on, and the lesions covered with flexible collodion. Another effective and cleanly method of employing the drug, which is very useful for small isolated lesions, is in the form of crayons, for which the following is a useful formula: Chrysarobin, 3 parts; White Wax, 2 parts; Lanoline, 5 parts. This is melted and poured into a mould about the size of a pencil.

Chrysarobin may also be applied in the form of plasters, such as those of the Biersdorf series, which can be had in various strengths and combinations from 2 to 10 per cent. These latter methods, though cleaner than the ointments, are not so effective.

The staining of the skin, which exists after the employment of chrysarobin, may be got rid of by applying the following ointment: Resorcin., gr. 15; Glycerin. Amyli, ʒij; Paraffin. Moll., ad ℥j.

For the removal of the discoloration of the nails the best method is to soften them with soft soap, then scrape them with a piece of glass. In the case of the dirty, greenish staining of the hair caused by it, time alone will efface it.

In spite of its many disadvantages, in suitable cases, and if properly applied, chrysarobin is by far the most satisfactory local remedy for psoriasis at present at our disposal; but like many other powerful medicaments, it is a good servant but a bad master.

Anthrarobin, a drug of much the same composition as chrysarobin, has been introduced as a substitute for it, being less irritating, but it is at the same time less efficacious, and has the same disadvantage of staining the skin and dyeing the clothes a brownish-red colour.

Tar is perhaps the most commonly employed reducing agent. It may be used in a number of forms, all of which have their special indications. In addition to the pix liquida and its ointment there are the vegetable tars, ol. cadini (juniper tar), ol. rusci (birch tar), and ol. fagi (beach tar). Of these the most popular is the oil of cade, because while its therapeutic action is similar to that of the others, it is somewhat less irritating. The coal-tar preparations are also extensively employed, namely, the alcoholic extract known as liquor carbonis detergens, the officinal liquor picis carbonis, and creolin.

When the disease is widely distributed and sub-acute the most convenient method of employing tar is in the form of tar baths. To make an effective tar bath, add creolin (℥ss), liq. picis carbonis (℥ij), or oil of cade (℥ij) to 30 gallons of water at about 98° F. Another useful plan is to paint the lesions with pix liquida, or rub them with pix liquida (3 parts) in soft soap (1 part), or with a mixture of oil of cade and glycerine of starch, then immerse the patient in a warm bath and remove the tar with soft soap. Whichever form of tar bath is chosen, it should be continued daily until the lesions have disappeared.

In addition to the tar bath it is usually necessary to apply tar to the individual lesions, and the following tar ointments may be employed for this purpose: Ung. Picis Liquidæ. To this may be added 3 per cent. of salicylic acid, or 20 per cent. of soft soap to strengthen it. ℞. Creolin, ʒj; ℞. Soft Paraffin, ℥j. ℞. Oil of Cade, ʒij; Soft Paraffin, ℥j.

In place of ointments the oil of cade may be mixed with olive oil or glycerine of starch and rubbed on with lint; in very resistant patches it may be applied pure.

On the whole, the coal tars are best, as they are the most penetrating and anti-pruritic of the tar preparations. In chronic patches an excellent treatment is to rub in the liq. carbonis detergens or the liq. picis carbonis with a nail brush, then dress the lesions with zinc plaster or apply compresses of dilute glycerine of the subacetate of lead. A more active preparation of coal tar than the liq. carbonis detergens was introduced by Leistikow under the title of "linimentum lithanthracis," which consists of coal tar (3 parts), 95 per cent. alcohol (2 parts), ether (1 part). It is very useful in old-standing, resistant patches, and should be rubbed on and the patches then covered with zinc plaster. The liq. carbonis detergens can also be used as an ointment in soft paraffin (1 in 8).

For the face strong tar preparations should be avoided, but the following ointment may be used: Liq. Picis Carbonis, ♏10; Acid. Salicyl., gr. 10; Hydrag. Ammon., gr. 10; Paraffin. Moll., ad ℥j.

In the case of the scalp the same ointment is useful, with the addition of ʒj of soft soap.

Should irritation or marked acne supervene as a result of the tar applications it is advisable to stop them, and to wash the skin thoroughly with a super-fatted soap and to apply zinc ointment or a mild sedative cream, such as: Prepared Calamine, ʒj; Zinc Oxide, ʒj; Almond Oil, ℥j; Lime Water, ℥j.

The great disadvatages of the tar applications are that they are dirty, have a disagreeable odour, tend to cause an acneiform eruption, and if too extensively used may produce toxic constitutional symptoms.

Pyrogallol has been recommended as a substitute for chrysarobin, but it is a less powerful and even dirtier remedy, and stains both the skin and linen. It cannot be used over large surfaces, as it is liable to be absorbed and to cause severe toxic symptoms, such as nausea, collapse, strangury and hæmoglobinuria. It is usually employed in the form of an ointment of from 2 to 6 per cent. in vaseline, or in the following: Salicylic Acid, gr. 15 (after Richter); Ichthyol, gr. 15; Pyrogallol, gr. 15; Olive Oil, ʒj; Anhydrous Lanolin, ℥j.

As substitutes for pyrogallol, lenigallol and eugallol have been recommended, but they are less efficacious. They are applied by painting them on the patches, either pure or diluted with acetone, and then applying zinc paste or dusting power. This darkens the patches, and a scab forms which separates in a week. One or two such applications may suffice to remove the lesions.

The other keratolytics or reducing agents, such as ichthyol, resorcin, and β-naphthol, all have their supporters; but, in my experience, none of them is so generally useful as tar, or in resistant cases so effective as chrysarobin.

Psoriasis of the Scalp.—After removing the scales by softening them in olive oil and shampooing with soap-spirit lotion, one or other of the following ointments should be rubbed in: Sulphur. Præcip. or Hyd. Ammoniat., gr. 15; Acid. Salicylic., gr. 10; Paraffin. Moll., ad ℥j. To this may be added in resistant cases liq. picis carbonis (♏10), and when the scalp is thickly covered with scales, instead of the vaseline equal parts of soft soap and vaseline may be employed as a base.

The washing and the application of the ointment should be done daily at first; then less frequently till the scaly lesions have all disappeared. A useful procedure, especially in women, is to rub in the ointment at night, wash the scalp in the morning with the soap-spirit when necessary, and rub in daily one or other of the following lotions: ℞. Acid. Salicylic., ʒj; Ol. Ricini, ʒij; Spirit. Vini Rect., ℥vj. ℞. Resorcin., ʒj; Glycerini, ʒss; Spirit. Vini Rect., ℥ij; Aq. Rosæ, ad ℥vj.

Psoriasis of the Nails.—When the nails are affected with psoriasis it is difficult to cure them. They may be pitted, rough on the surface, ridged, or stained a dirty brown. They should first be softened with soft soap, freely applied on a piece of lint, and covered by an indiarubber finger-stall, or a 5 per cent. solution of caustic potash may be employed, after which they should be scraped by a piece of broken glass, and any heaped up epithelium removed from the free border. An ointment containing salicylic acid (gr. 15) and soft paraffin (℥j) should then be rubbed over the nail, pushed up beneath it, and the fingers dressed. It is inadvisable to use chrysarobin or pyrogallol on the nails on account of their staining properties.

X-rays.—There is still another method of removing the psoriatic lesions, namely, by the X-rays. This method is most applicable in the case of chronic resistant patches. With the skin at a distance of 15 cubic centimètres from the anti-cathode a dose of about three-quarters of a Sabouraud pastille is given, which is usually sufficient to clear the patch; if it is insufficient, a further half-dose may be given in a fortnight. Though the X-rays can remove any patch of psoriasis, like other methods of treatment they do not prevent a recurrence, and as it is a delicate and difficult operation, and an over-dose is associated with such serious consequences, it should not be recommended as a routine method of treatment, and should only be undertaken by an expert.

After-Treatment.—In a favourable case suitably treated the eruption should be got rid of in a month or six weeks. This is far from being the case, however, in those cases in which the treatment is carried out in a half-hearted fashion, or when the patients are addicted to alcohol, such cases being so obstinate that many months may be required to eliminate the condition. As the disease tends to recur treatment does not cease with the removal of an attack, but should be continued in a modified form to prevent recurrence or render future attacks milder in character. After the last spot has disappeared the patient should be advised to have a warm bath several times a week, and wash with ordinary toilet soap. Various medicated soaps, such as tar soap, sulphur and camphor soap, or beta-naphthol soap, have been strongly recommended for this purpose, but the short time the soap is in contact with the skin, and its dilution with large quantities of water, render the action of the drug incorporated with it practically negligible. After coming out of the bath and drying the skin, it should be rubbed with olive oil, almond oil, or cold cream, so as not to let it get too dry. A mild tar and salicylic ointment, or a 2 per cent. beta-naphthol ointment in cold cream, should be rubbed into the sites of predilection of the disease every second night, and the patient advised to take plenty of exercise, so as to promote perspiration. Irritating woollen under-garments should be replaced by silk and wool, cotton or linen. By these means, if the patient will only carry them out thoroughly, the chances of recurrence are lessened, longer intermissions may be expected, and in time a complete cessation of the disease may take place.

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PURPURA.

In a disease such as this, with various types and various degrees of severity, treatment must vary greatly.

Firstly, one must consider the possibility of the hæmorrhages being symptoms of some other disease. Stelwagon[1] divides the causes into three classes, viz., vasomotor, toxic, and infectious, and all these will be found to affect treatment.

Whatever the origin, one knows that rest will throw less strain on the blood-vessels, and it must be enforced except in the very mildest cases. With attention to the digestive organs and intestinal antiseptics if required, and in any case light diet most cases get quite well. In rheumatic varieties salicylates and their derivatives have been beneficial in my hands, but some do not consider they have any value. In other forms I rely on pushing the disinfectants of the digestive tract (salol and beta-naphthol), but if digestion is apparently normal, quinine, ergot and turpentine should be tried, and they are often successful. Ergot is best given hypodermically. Lastly, in the very grave fulminating types adrenalin solution (in 10 min. doses every two hours) is unequalled. Locally, styptic swabs or tampons are in rare cases required for the nasal and other mucous membranes.

Gaucher[2] advises large doses of lemon-juice mixed with powdered sugar for all cases, and 15 gr. of calcium chloride, t.d., and hypodermics of ergotin and adrenalin ($\frac{1}{10}$ milligramme) in the more severe stages. Nitrate of silver ($\frac{1}{6}$ gr., t.d.), originally recommended by Poulet, has been praised by others.

Muggia[3] finds that the injection of 300 units of diphtheria antitoxin every five days is of great service; he considers it better than adrenalin. It is sometimes followed by a reaction, and it acts simply as serum. Boulloche, quoted by Stelwagon, as far back as 1896 had success in a fulminating case with an injection of 120 cubic centimètres of artificial serum.

Bettmann[4] recommends a 5 per cent. solution of calcium lactate in $\frac{1}{2}$ to 1 drachm doses, t.d., an hour before each meal, and from eighteen months' trial considers it very valuable. Most workers have found that lime salts have not fulfilled their early promise.

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[1] Stelwagon, H. W., "Diseases of the Skin," 6th ed., Philad. and Lond., 1910.

[2] Gaucher, E., "Diseases of the Skin," Transl. 1910.

[3] "La Pediatria," Napoli, September, 1909.

[4] Münch. Med. Wochenschr, 1909, LVI., p. 1273.

RINGWORM.

THE modern treatment of ringworm on the trunk or smooth skin being entirely different from that on the scalp, the two must be considered separately. On the skin all that is necessary is to apply a powerful antiseptic which has a special quality of penetration. Iodine is in all probability the most satisfactory, and should be painted on once daily in the form of the following solution: ℞. Glacial Acetic Acid, ʒj; Tinct. Iodine, ad ℥j. This is a very strong solution, and it will be found that some skins, especially the softer parts of the body, will react too violently, in which case it should be diluted with an equal amount of water. The object of the acetic acid is to remove the top layers of the epidermis so that the iodine can penetrate still further; after a few days' application of this it will be found in all probability that even the toughest skin is beginning to get sore, in which case a mild sulphur and salicylic acid ointment (Sulph. Præcip., gr. 15; Acid. Salicyl., gr. 10; Adipem Benzoatum, ad ℥j) should be used until the skin has recovered, and then the iodine solution applied again; it will be found that on the second application the reaction will take longer to come up. By this means almost any ringworm on the smooth skin can be cured in a fortnight or three weeks. The other disinfectants which have been used are oleate of mercury and the oleate of copper. When the area of infection is extensive it is advisable to disinfect the clothes by heat, more especially in the case of the tropical ringworms, as, for example, the common "dhobie itch," Tokelau ringworm, Burmese ringworm, etc.

On the scalp we have to deal with entirely different conditions, and the cure is by no means so easily produced. There is no doubt that, both from the public health point of view and from that of the individual patient, Sabouraud's treatment by depilation by X-rays is far the most satisfactory. It is, however, necessary to warn the practitioner that the treatment requires considerable skill and experience to carry out, and even when the greatest care is exercised an occasional disaster, in the shape of an incomplete recovery of hair, may take place. Whether this is due to an individual idiosyncrasy on the part of the patient, that is to say, that he has not the normal resistance to X-rays, or whether there is still some factor in the measurement of X-rays which has not been thoroughly grasped yet, has been warmly discussed by authorities on both sides. The writer is of the opinion that there do exist some people whose skin is more easily irritated by X-rays than others, and he is certainly convinced that there are some children who have an increased resistance, and in whom the full Sabouraud dose does not produce depilation; as an example of the latter he can recall one case in which the whole scalp was exposed on three separate occasions at two months' interval without resulting in any depilation worth speaking of. As regards the former, that is to say, increased susceptibility of the skin, on one occasion he X-rayed two children, brothers, on the same afternoon, using the same tube, the same set of pastilles, and under precisely similar conditions; in fact, the exposures were given to the boys alternately in order not to fatigue them, with the result that one child did perfectly, showing a normal depilation, whereas the other showed an inflammatory reaction within a week, in one or two places quite marked, and a resulting incomplete growth of hair some months afterwards. In this instance every care was taken to test the pastilles accurately, and, in fact, the conditions were similar in every respect. As regards the possible effect of X-rays on the child's brain, the practitioner may ignore this suggestion entirely. So far no case which would stand thorough investigation has occurred, although by this time the exposures must have numbered hundreds of thousands. Again, in experiments made on the skulls of children taken fresh from the post-mortem room, it is found that through the thinnest part of the parietal bone in a child of eight the highest dose which can penetrate is one-third of the full dose. Moreover, brain tissue does not appear to be particularly susceptible to X-rays.

The treatment is carried out in two ways: (1) If there are only a few isolated patches, localisers are used, after the manner originally described by Sabouraud; (2) if the whole head has to be treated, that is to say, if there are more than five separate exposures to be made, it is done by what is known as the Kienböck method. The child's head in the former case is placed against a lead-glass circular localiser of diameter not exceeding 9 centimetres (if a larger size is used it will be found that owing to the child's head not being flat the centre of the exposure will come too near the tube and an overdose will be given, whereas at the edges the dose will in all probability be too small); this localiser is of such length that the child's head is 15 centimètres from the centre of the tube. It is advisable that the exposures should extend for at least 1 centimètre beyond the edge of the patch. In *the Kienböck* *method*, where it is necessary to depilate the whole scalp, this is so mapped out that it can be done in five exposures, whereas if localisers were used, at least eight or nine would be necessary; there is thus a considerable saving in time and expense. The scheme by which the scalp is mapped out is that an exposure should be given over points which are not nearer than 5 inches from each other. Thus a tape measure is taken and placed longitudinally along the top of the head in such a manner that the 5-inch mark is in the centre of the vertex, the 10-inch mark in the sub-occipital fossa; the zero will be then in the centre of the frontal region, a mark is made with a blue pencil on each one of these points, the tape is again taken and placed round one side of the scalp over the parietal bone, the zero and 10-inch mark are put in the same position as before, the 5-inch mark will then be immediately above the ear; this point is also blue pencilled, and a similar point marked above the ear on the opposite side. The tape is then put transversely across the scalp from one ear to the other in such a manner that the zero coincides with the mark above the left ear, the five with the mark previously made on the vertex and the ten with the mark over the right ear; it will thus be seen that the frontal mark is 5 inches from that on the vertex and 5 inches from that over each ear, the occipital mark is also 5 inches from each one of these points, and the vertical mark is 5 inches from all of them. The child's head is then placed against three slender posts made either of gas carbon or light wood, whose length is such that the scalp is again 15 centimètres from the centre of the tube; these three posts slope towards one another but do not quite meet the space in between; their points will coincide with the blue pencil mark made on the scalp, and exposure is then given over each mark in turn; in this way the centre of the area exposed on each occasion gets a full dose, but the periphery gradually gets less and less the further away it is from the centre. This is, however, compensated for in the subsequent exposure, as the further a point is from one mark the nearer it will be to one of the others, and in this way the aggregate total dose is made up. It is very important to cover up with lead or some other impervious material the ears and the neighbouring parts of the face, forehead, and neck, so as to protect them from the X-rays. The pastille made of platino-cyanide of barium, known as the Sabouraud-Noiré pastille, is placed in both these methods at half the distance from the centre of the tube that the scalp is, that is to say, 7·5 centimètres; the exposure is continued until the pastille corresponds in colour with the standard teinte B (judged by daylight). During the exposure the pastille must be protected from strong daylight, either by darkening the room or by covering the pastille with black paper. Sunlight has the effect of making the pastille return to its original colour, so if it is not excluded the reaction will be retarded, the exposure too long, and a burn will be the result. As regards apparatus, the current can be provided either by static machine as in Sabouraud's original method, or by a coil, as is more usual in this climate; the tube must be small in size, as otherwise the wall of the tube will be too near the pastille, and the latter will be affected by the heat generated. The Drissler tube appears to be, on the whole, the most satisfactory, and has the advantage of being very cheap, although, as a rule, in hospital practice only about one tube out of every three is able to stand the strain of continuous running. The tube should be contained in a metal or lead-glass shield so as to protect the operator, and in doing the Kienböck method suitable gloves should be worn by the nurse or person holding the child's head. Before starting the exposure it is advisable to test the various distances and see that the tube is in the centre of the aperture; in the Sabouraud shield made by Drault, of Paris, this can be very accurately done by a screw adjustment, and this apparatus has certainly the best form of shield on the market, although very expensive.

It is very important that no strong antiseptic, more especially iodine in strong solution, should be applied to the scalp either immediately before or after the exposure to X-rays. If tincture of iodine has been painted on, it is advisable to wait a fortnight before exposing the scalp; the most suitable application for use after X-ray treatment appears to be the weak salicylic acid and sulphur ointment referred to above; Sabouraud uses iodine in weak solution (tincture of iodine, 10 parts; alcohol, 90). The head should be washed with soft soap and warm water every night, and one or other of these applications carefully rubbed in or painted on. The child should have the hair clipped quite short before treatment, so that the whole of the disease may be shown up. Some time between the fifteenth and the twenty-first day the hair will begin to fall. The usual date is the eighteenth day. The parents should be particularly careful to use the mild disinfectant ointment or lotion at this stage, as it should not be forgotten that the hairs which fall out are still infected, containing, as they do, live fungus. At the end of three weeks, if there are any stumps left, these should be scrubbed well out in the washing or removed with forceps; at the end of the fourth week the child should be free from infection, but the applications should be continued until the hair begins to grow again, which it does at the end of the third month, first of all as a fine down, which at the end of the fifth month becomes normal in thickness and general appearance. During the whole time the child should wear a cap, of which the lining can be removed easily for disinfection, or else it should be lined with tissue paper, which can be burnt each day. The child should be kept away from school until all the stumps have come away, and no other child should sleep with it or use the same towels, brushes, etc.

In cases of **kerion**, that is to say, **pustular ringworm**, it is not wise to use X-rays, and in the majority of cases it is not necessary, as the profuse suppuration in the follicle causes it to discharge its hair and the fungus, fulfilling the same purpose as the X-rays. If X-rays are used in kerion one is very liable to get an increased reaction from the combination of pustulation and X-rays and a resulting incomplete re-growth of hair, or even definite scarring with complete alopecia. Kerion should be treated, therefore, with mild antiseptic ointment, such as ung. hydrarg. ammon., half B.P. strength, in order to prevent the pustulation from being too profuse and infecting other places. It should not be forgotten, however, that a certain amount of pustulation is required in order to produce the cure, and, therefore, too energetic measures should not be taken to check it; but the writer does not go so far as some authorities, who say that the pustulation should be encouraged by potato poultices. The writer does not think it is wise to X-ray cases in children under the age of three; firstly, because in infancy the disease can often be cured fairly easily by chemical means; secondly, because there is perhaps slightly more risk; and thirdly, because there is usually great difficulty in getting a child so small to keep still, although, of course, many children under this age have been treated quite satisfactorily with X-rays. Again, it is doubtful whether it is worth while doing after the age of fifteen, as in a vast majority of cases ringworm is automatically cured at puberty. The time saved by the X-ray method is in view of education, which is such an important matter at this age, a very strong factor in urging this treatment. The scalp should be normal in five months, and, indeed, except from the point of view of appearance, the child could go back to school often long before this, whereas by the older method the average length of cure, even in the most skilled hands and in institutions where the children were looked after by competent nurses, was from eighteen months to two years.

When it is impossible, or for some reason inadvisable, to carry out the X-ray treatment, the next best method is to try and produce pustulation with strong irritants, and so produce artificially the conditions we find in kerion ; the most satisfactory method of doing this is with croton oil (carbolic acid, 1 part; croton oil, 19 parts). This should either be rubbed in generally over the patch, or else where the lesion is small applied to each follicle with the special needle invented by Aldersmith. This treatment is best carried out by the doctor himself, as it is not wise to give strong irritants like croton oil to the ordinary out-patient mother to be rubbed in carelessly. The treatment is very painful to the child and very tedious to the practitioner. Equal parts of common salt and vaseline may also be used instead of croton oil ; it is not so painful to apply, but neither is the effect so rapid. If one decides to treat the case with antiseptics, the most satisfactory is iodine painted on in the shape of the pure tincture of iodine or oleate of copper ointment (10 to 20 per cent.).

Ringworm of the beard, whether pustulating or not, may be treated with X-rays in the same manner as the scalp ; but it is advisable not to give quite the full dose on the face, as the skin is certainly more easily irritated than that of the scalp, and this is particularly so if pustulation is present, when the reaction may be still further marked. The writer's usual practice is, therefore, to give only a three-quarter dose, that is to say, the teinte B of the pastille should be tested by electric light from an ordinary carbon filament lamp. It is true that this will often necessitate repeating the exposure, as the hairs may not come out with so small a dose, but it is preferable to do this than to overstep the mark and produce any disfigurement on the face.

Where X-ray treatment cannot be carried out, depilation must be done with forceps, which will require repeated sittings, but if persevered with does in the end produce a good result ; in the pustular variety it is hardly ever advisable to make an incision over the swelling, even though fluctuation is felt. If an incision is made, it will be found that instead of pus coming out the mass consists of a semi-solid granulomatous condition, which only exudes a glairy serum. As regards suitable applications, this will depend on the acuteness of the inflammation. When there is considerable pain and swelling, hydrogen peroxide fomentations (10 vols.) should be used for some days until this has been reduced ; later the oleate of copper ointment referred to above and the oleate of mercury ointment (B.P.) [U.S.P. mercuric oleate, 20 gm. ; benzoated lard, 60 gm.], or in the more resistant cases chrysarobin ointment, will be found the most satisfactory. It is advisable to keep the patient under observation for some time after he appears to be well so that any recurrences may be treated at once.

Ringworm of the Nails.—This condition is extremely resistant to treatment, and unless attacked very energetically may go on for years. There is no doubt that the quickest method of curing the disease is to remove the nail entirely, and then by application of disinfectants to the nail-bed thoroughly eradicate the disease before the new nail grows up. After removal of the nail the most suitable application is tincture of iodine; this should be diluted with three times the amount of 60 per cent. alcohol to start with, and the strength of the solution gradually increased as the patient can stand it; this should be applied with a brush twice daily, and between the dressings the finger-tips should be covered with indiarubber. When the infection is only slight and at the distal end of the nail, the cure may be reduced by scraping the nail, dabbing on during the scraping some liquor potassæ to make the maceration more easy; it is advisable to smear a little vaseline over the surrounding skin, otherwise this would be made very sore by the strong potash. This scraping and maceration of the nail must be continued three times weekly until all the diseased part has been removed, tincture of iodine or chrysarobin ointment being used as a dressing.

WILFRID S. FOX.

RODENT ULCER.

Free and Wide Excision is still, in all probability, as satisfactory as any form of treatment, but nine-tenths of the cases occur on the face, and tend particularly to be placed in awkward little corners, so that complete excision is practically impossible. In these cases **radium** gives, on the whole, the most satisfactory results. In the early stages the cure is, as a rule, definite and complete, and in the later stages, when the ulceration has penetrated deeply or has produced considerable destruction, as, for example, in the neighbourhood of the orbit or nasal cavities, radium still is more powerful in controlling the spread of the disease and healing up tissues, where possible, than any other agent. The salts of radium which are used are either the bromide or the sulphate. The latter is preferable, as it is insoluble. It should be mounted on a flattened metallic surface—not in a circular tube—and covered with the special varnish. The length of exposure will, of course, depend on the amount of radium at the disposal of the operator. It is best to cut out the softer rays either with the specially prepared French guttapercha, or with aluminium foil or thin lead, as there is no advantage in inducing too lively a reaction. When the total exposure cannot be conveniently given at one time, it is best to do it on consecutive days. Thus, for example, if one had 25 milligrammes spread out on a flat surface of the size of a sixpence, and one were to insert two layers of thin aluminium foil between the radium and the ulcer, the usual exposure to cure a rodent ulcer of not very long standing, or which, at any rate, had not penetrated very far, would be about two hours, and it would be best to divide that into one hour's exposure on two consecutive days. It is, however, impossible to give very definite instruction as to the length of time, as every case varies, and the operator must gain his experience from his own particular piece of radium and from the treatment of similar cases. After exposure to radium the ulcer should be kept clean by bathing with weak antiseptics, such as boracic lotion, and calamine lotion should be dabbed on at frequent intervals. The reaction usually shows itself in about a fortnight, when a very hard and adherent scab gradually makes its appearance; it is in shape not unlike a rupial scab. The scab should not be detached, but should be allowed to drop off: this usually take place about the end of a month, when a flattened healed surface will be seen. As a rule, however, a secondary reaction appears, which runs exactly the same course as the primary, only sometimes it is more active, so that the whole process will occupy, on an average, two months. This secondary reaction is accounted for by the fact that the tissues themselves become radio-active. The resulting scar is usually supple and inconspicuous, telangiectases only making their appearance when the softer rays have not been eliminated, or when it has been necessary to give several doses. Radium, of course, has hardly been on the market a sufficient number of years yet to give an opinion as to the absolute permanency of the cure; but there is no doubt that, as far as the cases have gone at present, the results are good.

X-rays are satisfactory in healing up rodent ulcers in their early stages, or in curing the warty condition which precedes them. The chief drawback to their use is that the ulcers tend to recur, as a rule, in about eighteen months or two years' time. However, the recurrence can frequently be cured by the same means for a similar length of time; they therefore afford a fairly satisfactory and painless method of treatment in old people. They are, however, as a rule, of little use in the later stages of the disease, except that they may make the patient feel a little more comfortable. They should be given in large doses, that is to say, three-quarter or full Sabouraud doses, repeated once a fortnight or eighteen days, respectively, a localiser being used to limit the area of treatment to the ulcer only. As a rule, the ulcer will be found to be healed after four or five exposures. If there is no improvement by this time it is useless to persevere with the method. Calamine lotion may be applied as a dressing between the exposures.

The method of treatment by **ionisation** is of use in the early stages, but if attempted after the ulcer has commenced to penetrate, it will occasionally increase the rate of progress, and do harm rather than good. Both the zinc and the copper salts have been used, but, on the whole, the balance of opinion appears to be in favour of zinc, either the sulphate or chloride. There is no advantage in having a strong solution, anything from 1 to 3 per cent. being sufficient. Circles of lint are cut corresponding in size to the ulcer; these are soaked in the solution, and during the operation are re-dipped every five minutes. Two or three layers of this lint sodden with the solution are placed on the ulcer, and a solid zinc or copper electrode (according to which solution is being used) is placed on the circles of lint and attached to the positive pole of the battery, the negative pole being a pad applied to some convenient area of skin. A current of 10 to 15 milliampères is then run through the circuit, and the ions of metallic zinc or copper are driven into the tissues. The operation continues for a quarter to half an hour, firm pressure being kept on the positive electrode. At the end of the operation the tissues over the treated area will be seen to be white from the fine particles of zinc. The process is repeated about every three weeks until the ulcer is healed and all induration at the edge removed. As with X-ray treatment, the ulcer is liable to recur after a year or two.

Finsen light is sometimes successful in producing a cure, but it is most useful in combination with X-rays or radium. The application of various chemical caustics has rather gone out of fashion of recent years, because, if the treatment is not sufficiently active to destroy the growth, it often seems to irritate it and make it spread. (*See also* Tumours, Vol. I.)

WILFRID S. FOX.

ROSACEA (ACNE ROSACEA); RHINOPHYMA.

The treatment must be both general and local. In the early stages, at any rate, the former is the more important. The reflex cause must be sought out and, if possible, corrected; uterine and pelvic disorders should have appropriate treatment, which is outside the province of this article. Gastro-intestinal dyspepsia should be treated by the recognised methods. The diet should be carefully attended to, and those articles of food eliminated which are found by experience in the particular case to cause flushings. The patient should, if possible, do without alcohol altogether. If he must have something the most suitable drink is hock diluted with mineral water; champagne, cider, port, burgundy, and spirits are bad; coffee, and in some cases tea, should be forbidden. Constipation should be relieved, and if this cannot be done by a suitable diet, drugs must be resorted to. When the patient has always to take a purgative, cascara and aloes are best. The well-known dinner pill composed of Ext. Nucis Vom., Ext. Belladon. Virid. āā gr. ss; Aloin., gr. 1 [U.S.P. Ext. Nucis Vom., gr. ½; Ext. Belladon. Fol., gr. ⅓; Aloin, gr. 1] taken twice daily with meals is generally very efficacious. Saline waters are good temporarily, but tend to lose their effect if they have to be continued for very long. The one drug which does appear to act as a specific in some of these cases is ichthyol. It has been strongly advocated by Sir Malcolm Morris, who gives it in 5-gr. doses in capsules twice daily, early in the morning and late at night, gradually increasing up to 10 gr. as required. It should be continued for several weeks until the stomach appears less irritable and ordinary plain food is taken. Bismuth and strychnine are also of assistance in some cases. Arsenic is useless, and frequently makes the dyspepsia worse.

The patient should avoid sitting close to a fire, should protect the face from cold winds, especially in motoring, or from bright sunlight. Cold water should never be put on the face, and if the water is very hard, even when hot, bran or oatmeal should be put in it before bathing the face.

In the early stages, when the flushings are intermittent, very little in the way of local treatment is required. A calamine lotion by day and a mild ichthyol cream by night (made up as follows: ℞. Ichthyol, ♏15; Zinci Oxidi, ʒvj; Adipis Lanæ Hydrosi, ʒij; Ol. Olivæ, Liq. Calcis, āā ℥j), are all that are necessary.

When there is any sign of seborrhœa being present, either early or later on in the disease, then stronger measures should be taken. The three drugs which are of use are sulphur, resorcin and mercury, and they are efficacious, as a rule, in that order. It is often remarkable what strong lotions a bright red, inflamed-looking seborrhœic nose will stand. The following lotion is one which will be found suitable in most cases: ℞. Sulph. Præcip., Zinci Sulphatis, Potassii Sulphidi, āā ʒjss; Aq. Rosæ, ad ℥viij; or, if something stronger is required: ℞. Sulph. Præcip., ʒss; Resorcini, gr. 15; Spirit. Rect. ad ℥j.

Pustules should be opened with a small acne spud and the pus removed. Papules which are resistant and hard should be touched with a fine electro-cautery. Injected venules can be destroyed either by negative electrolysis, passing the needle on the negative pole along the vessel with a current of 1½ to 2½ milliampères running, or by criss-cross scarification.

X-ray treatment is sometimes useful both in the papular and the hypertrophic varieties; it should, of course, be carefully given in measured doses of a three-quarter Sabouraud dose every fortnight, that is to say, the pastille should be judged by electric light and not by daylight.

When there are large nodules and pendulous masses, these should be treated by scarification and by wholesale removal, pruning the nose down to the required shape. The islands of epidermal cells which are left by the sebaceous tracts being cut across act like skin grafts and give quite good results. There is a certain amount of risk of sepsis spreading after the operation and producing erysipelas or cellulitis from the pustular sebaceous glands which may be cut across, and also on account of the boggy and unhealthy tissues around. It is therefore advisable to bathe the part freely with antiseptic lotions during the operation.

WILFRID S. FOX.

RHINOSCLEROMA.—*See* Diseases of the Nose.

SCABIES.

It is essential in the treatment of scabies not only to cure the individual of the disease, but to prevent re-infection both from his clothes and from other inmates in the house. It is, therefore, advisable if one member of a family is suffering to examine the others, and treat all those affected at the same time. The most satisfactory method is to lather the patient all over with soft soap; the potash in the soap, dissolving off some of the top layers of the skin, allows subsequent application to penetrate more satisfactorily. After thorough soaping the patient should lie in a hot bath for a considerable time to wash away all the lather. He should then be dried, and the following ointment rubbed well into the skin: ℞. Sulphuris Præcipitati, ʒj; Potassii Carbonatis, ʒss; Adipem Benzoatum, ad ℥j. The object of the potassium carbonate is to assist penetration of the sulphur. It is advisable in order to carry out this treatment thoroughly to expend an hour—twenty minutes for each process. When this is done thoroughly in a public institution it is found that, as a rule, one-third of the cases are cured in one sitting. While the patient is undergoing the treatment his clothes should be sterilised by heat. The reason of the failure of the treatment in the majority of the cases is due to re-infection from the night clothes, or from other members of his family. In ordinary out-patient practice, where there are no facilities for disinfection except the domestic oven, it is generally necessary to repeat this treatment four nights in succession, then wait three days, and repeat again for four nights. At the end of the fortnight the majority of the cases are cured. It is, however, important to impress upon the patient the necessity of disinfecting the night clothes, as the parasites practically only come out at night.

When there is much suppuration for which the above ointment would be too strong, it is advisable to use a mild sulphur cream, made up as follows: ℞. Sulphuris Præcipitati, gr. 15; Zinci Oxidi, ʒvj; Adipis Lanæ Hydrosi, ʒij; Olei Olivæ, Liquoris Calcis, āā ℥j.

In dealing with young infants, whose delicate skin will not stand these stronger methods, the most suitable remedy is β-naphthol, the form of a 2 per cent. ointment.

In adults who have a sensitive skin and a predisposition to eczema, Peruvian balsam is less irritating and a more satisfactory remedy than sulphur. It should be painted on at bedtime, left on all night, and washed off in the bath in the morning, this process being repeated until the disease is eradicated.

Milder treatments, such as sulphur baths, painting the affected parts with sulphur in collodion, are frequently satisfactory, but are much slower.

In private practice, where one is dealing with more cleanly people, it will be found that the patient requires the sulphur ointment more thoroughly rubbed in and more frequently applied to complete a cure than in the less cleanly classes, the reason being that suppuration, which assists in the destruction of the burrows, takes place more easily in the unwashed.

WILFRID S. FOX.

SCLERODERMIA.

Milder Cases get quite well if left alone, but in the severer types one has to guard against atrophy of limbs or even death.

Massage takes first place in my opinion as a remedial agency, and it has to be persisted in for long periods. Coupled with this the use of X-rays is extremely valuable, and, indeed, I have seen some localised cases get all right with this alone. A tube with a spark-gap of 3 to 4 inches and ½ milliampère in the secondary circuit should be used, and the exposures given should be of ten minutes' duration twice weekly. Reaction of any severity is to be avoided.

Jackson[1] recommends the rubbing in of salicylic acid in oil, and has noted marked improvement. Piffard[2] verifies this, and also finds the application of thiosinamin by cataphoresis very satisfactory. Thiosinamin may be injected in doses of 1 or 2 gr. hypodermically; this is best made up in a dilute solution of glycerine and introduced deeply every other day. Ampullæ of its congener fibrolysin are used similarly, and some successes have been recorded.

Roques[3] has summarised the effects of organotherapy. Thyroid being most effective and supra-renal and pituitary glands less so, he advises their employment in all cases: "alternate each drug and combine some and wait patiently for results."

Sclerema Neonatorum is fortunately rare, as when widespread it is almost uniformly fatal. In these and milder cases one has to keep up the child's temperature by swathing in cotton-wool and seeing to the adequate supply of proper nourishment. Inunction with simple vaseline is also to be carried out.

F. GARDINER.

References.

[1] Amer. Jour. of Cutan. Dis., 1909.
[2] *Ibid.*
[3] Ann. de Dermat. et de Syph., Paris, 1910, 5 sér. I., pp. 383—400.

SEBACEOUS CYSTS.

The only treatment which appears to be worth considering for this condition is excision. When the cyst has not suppurated this is generally an extremely easy proceeding. An incision is made straight over the small swelling, the skin dissected back, and the whole cyst shelled out without rupturing it; the incision is then sewn up, either with horsehair or by buried sutures, or both. The operation can be done under a general or local anæsthetic. Dressings of gauze and collodion should be applied and the wound left untouched for a week, when the stitches may be removed and a similar dressing applied for another five or six days. When the cyst is situated on some exposed part of the body it is advisable to remove the stitches considerably earlier, in some cases in forty-eight hours, as it should not be forgotten that if there is any dragging on the stitches the stitch hole scars are frequently more disfiguring than the linear scar of the wound itself. When the cyst has already suppurated it is advisable to make an oval-shaped incision, which includes within its limits the orifice from which the purulent discharge is exuded; the cyst will then be dissected from the surrounding subcutaneous tissue as described above, only it will be found, in all probability, that this is not nearly such an easy matter as shelling out an uninflamed cyst. By this means one can avoid the pus from within the cyst contaminating the healthy tissues around, and as a rule the wound can be stitched up and will heal as satisfactorily as in the uninflamed condition. There is usually plenty of skin on each side, after the oval piece in the centre has been excised, to bring the edges together nicely, owing to the cyst having stretched the overlying skin as it grew. This superabundance of skin, after the removal of a non-septic cyst, need not be interfered with, as in course of time the skin will contract again as a rule, unless the stretching has been excessive. If the cyst is only opened and the contents expressed, or if, in dissecting out, portions are left behind, in the majority of cases it will fill up again and recur.

WILFRID S. FOX.

SEBORRHŒA.

By this is meant oily seborrhœa, usually of the face, frequently of course associated with either acne or rosacea. This is a much more difficult condition to treat than seborrhœic dermatitis on the trunk, but it can be considerably improved, and although apt to recur it can nearly always be kept under control by suitable treatment. Internal treatment has very little effect except when constipation and indigestion require attention. The lotions given under Seborrhœic Dermatitis will be found of use, but the milder ointments, especially those made up on a fat basis, should not be employed, as they only increase the already excessive greasiness. As a rule it will be found that something stronger than the lotions mentioned will be required as the skin gets used to them; it is wise however, to begin with the milder ones first and increase the strength as required. Of the stronger applications, that recommended by Sabouraud is generally very effective and is as follows: ℞. Sulph. Præcip., partes 5; Acid. Salicyl., Resorcin., āā partem 1; Paraffin. Moll. Alb., partes 30. *Sig.*: to be rubbed into the face at bedtime and left on all night, unless the reaction is too great and the patient cannot stand it. It should be washed off in the morning with hot water and a soap consisting of precipitated sulphur and green soap, equal parts. If this is persisted in, the skin will gradually get used to the strong irritants and a considerable improvement will be seen, but in all probability the patient will require to repeat the treatment three or four times a year for about ten days or a fortnight at a time. The patient should avoid eating very greasy things, such as hot buttered toast, muffins and greasy sauces.

SEBORRHŒA CAPITIS.

By this is meant oily seborrhœa of the scalp, which is chiefly confined to the male sex and is associated with that particular type of baldness which occurs in young men, and which ends in calvities. It does not include the condition described in the older text-books as seborrhœa sicca, as this is of course pityriasis or common scurf, the scales consisting of epidermal cells and not of dried sebum as the name seborrhœa sicca implied. It is true that the two conditions are frequently seen in the same patient, the pityriasis coming first during childhood, and the oily seborrhœa making its appearance after puberty. In this situation cure is impossible; the physician can only hope to delay matters and make the hair fall out more slowly than it otherwise would. The lotions given under Seborrhœic Dermatitis are the most suitable, preferably that consisting of sulphur, resorcin, and spirit; it should be scrubbed into the scalp at bedtime with a stiff brush. Alternately with this lotion, the following stimulating lotion may be used: Mercuric Perchloride, 1 part; Glacial Acetic Acid, 5 parts; Resorcin, 10 parts; Chloral Hydrate, 20 parts; Tincture of Cantharides, 80 parts: Rectified spirit, 1,000 parts. These two lotions should not be used at the same time, for if any of the sulphur is present in the first, black sulphide of mercury will be precipitated, making an objectionable dark discoloration. The patient should shampoo frequently, either every day or at least three times a week. Hot water should be used for this, never cold, as the cold water only tends to solidify the sebaceous matter and make it block up the follicles. The following shampoo-wash will be found satisfactory: Thymol, ʒjss: Saponis Viridis; Spiritus Rectificatus, āā ℥iv. As an alternative, quillaia is sometimes preferred, the shampoo-wash consisting of: Liquor Ammoniæ, ʒij; Tinct. Quillaiæ, ʒss; Spt. Rect., ad ℥iv. It should be explained to the patient that only negative results can be obtained, that is to say that the process can be delayed. It is impossible, of course, to get any antiseptic which will penetrate into the sebaceous glands of the scalp and kill the micro-bacillus of seborrhœa without at the same time destroying the skin.

WILFRID S. FOX.

SEBORRHŒIC DERMATITIS.

Synonyms.—Seborrhœic eczema or flannel rash.

This condition, which is usually found on the trunk, particularly in the centre of the chest, back and front, is generally easily cured by the usual anti-seborrhœic drugs. These consist of sulphur, resorcin and mercury, and are generally effective in that order. The patch should be well washed with soap and water or ether soap, and one of the following applications should be rubbed in firmly twice daily: Sulph. Præcip., gr. 15; Acid. Salicyl., gr. 10; Paraffin. Moll. Alb., ad ℥j; or when a lotion is preferred: Sulph. Præcip. Zinci Sulphatis, Potassii Sulphid., āā ʒvj; Aquam Rosæ, ad ℥vj. A stronger application consists of Sulph. Precip., gr. 3; Resorcin, gr. 15; Spt. Rect., ad ℥j. This latter should generally be used after one of the others, as if tried in the first instance it is apt to produce rather too strong a reaction.

The clothing which is worn next to the skin should not consist of any woolly or flannel substance, as very little progress can be made so long as the skin is being irritated and kept too moist.

Either thin merino or linen is the most suitable; heavy expensive silk is rather irritating. The warmth of the patient can be kept up either by wearing two thin vests instead of one thick one or by putting on additional clothing over the vest. As a rule the lesions can be cured in about a fortnight or three weeks, but in the tropics or in hot moist weather a cure may take rather longer.

WILFRID S. FOX.

SPOROTRICHOSIS.

The treatment of the cutaneous lesions of sporotrichosis consists of the local application of antiseptic ointments and the employment of the curette. Internally iodide of potassium should be administered. The lesions are singularly intractable to local measures but readily respond to the iodide.

J. M. H. MACLEOD.

SYCOSIS.

This is one of the numerous eruptions which is much more amenable to treatment, if such treatment is commenced at an early stage. It frequently starts on a seborrhœic basis and is accompanied by seborrhœa capitis. The scalp condition should be treated with soap spirit and an ointment such as : ℞. Sulphur. Præcip., gr. 15; Acid. Salicylic., gr. 10; Paraffini Mollis Albi, ℥j : this same ointment will often dispel a very early sycosis. A fully developed condition is, however, a microbic infection extending deeply down into the hair follicles: this is most intractable. Crusts must first be removed by the use of boracic starch poultices or oil soaks, and then the following ointment is to be rubbed in by deep steady inunction for fifteen minutes night and morning: ℞. Sulphur. Præcip., ʒj ; Hydrarg. Ammoniat., ʒ½ ; Paraffini Mollis Albi, ℥j. Shaving is, I think, justified, as although it causes some irritation, yet the resultant ease of application of remedies quite compensates. Prolonged lathering and a keen razor mitigate this evil. On the other hand, close clipping is often badly done, and may leave open wounds. Epilating by means of forceps is best done by the medical attendant, and can only be used over a limited area, as it is very rarely that one finds loose hairs and the process is distinctly painful. A good method in stubborn cases is the application of blistering fluid, and if carried out with caution it often removes obstinate patches. Generally about once a week is sufficient. For the obstinate, fully developed types the best treatment in addition to the continuance of the above is the use of staphylococcal vaccines, and the plan which I have found best is to inject fifty millions at first once in three weeks and then every two weeks if there is no reaction. This is a very slow plan and has to be continued for a year or more, but as the condition often has lasted for years, patients do not object.

In very obstinate cases one has to resort to X-rays, but this, in my opinion, should be reserved for those severe types occurring among the labouring class, where appearances are not so important. It is true that I have seen benefit from half-pastille doses, as suggested by Scholtz,[1] but mostly one uses this plan to produce depilation, and then there is the risk of leaving telangiectases and wrinkling behind. While recognising this possibility, it is at times justifiable to carry out this procedure rather than allow a patient to go about with a hideous eruption.

Only one or two ointments have been mentioned, but many variants have been proposed; the important point to remember is that one wants to get some antiseptic deep down into the follicles, and that thorough inunction is necessary.

Gaucher[2] regards resorcin as almost a specific, and uses it in 1 per cent. strength. Another ointment recommended by the same author consists of: ℞. Acid. Tannici, partem 1; Sulphuris Præcip., partes 2; Paraffini Mollis Albi, partes 20. Unna,[3] by means of his microbrenner with an irido-platinum needle, epilates the affected parts or else employs ointments of chrysarobin, pyrogallol or resorcin.

F. GARDINER.

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TRICHORRHEXIS NODOSA.

PROBABLY parasitic in origin, this disease is of a particularly rebellious character. To allow of proper application of antiseptics, the beard and moustache, which are generally the affected parts, should be shaved. Among the antiseptics used the favourite are 1 in 1,000 corrosive sublimate, peroxide of hydrogen and resorcin.

It would be justifiable to produce temporary depilation by means of the X-rays in cases causing much annoyance.

F. GARDINER.

TUBERCULIDES.

LUPUS.

The treatment of lupus, perhaps more than the treatment of any other skin disease, calls for the careful consideration of each individual case; not only the rapidity of growth of the disease, the amount of infiltration, the presence of ulceration, but the position on the body must be taken into consideration. A practical question, which is frequently of the utmost importance in forcing the practitioner into a certain line of treatment, is the amount of time the patient can afford to give up to his cure.

The general treatment of lupus is similar to that of tuberculosis in other forms, and consists in putting the patient into as healthy conditions as possible, both as regards food and surroundings. It is not necessary here to go into the details of this. In this article we are chiefly concerned with the local methods of attack. Lupus is not a disease which tends to get well by itself, and usually requires active and persistent measures to eradicate it completely. The most successful methods are excision, Finsen light, X-rays, cauterisation, erosion, scarification, local applications of a chemically destructive nature, and tuberculin vaccine treatment.

Excision.—There is no question that in cases where it is practicable to cut out the whole focus of disease and bring the edges together to form a good linear scar, this is the best treatment. The time saved is great, and the discomforts and tedium of the other methods are avoided. The misfortune is that in the large proportion of cases it is impossible to carry it out; either the patient does not come up for treatment until the lesion is too big, or the disease is situated on the face, and in such a position that it is important not to distort the surroundings. The operation can be done either under a local or a general anæsthetic, according to the choice of the operator or patient. The skin having been cleaned up in the usual manner, the incisions must be made wide of all the outlying tubercles, or else recurrences in the scar will be probable; the most fruitful source of this is the non-removal of an infected piece of subcutaneous fat. The edges should be brought together either by horsehair stitches or buried sutures. It is generally advisable to insert two deep fishing-gut sutures some distance away from the edges of the wound to take the chief strain if there is much tension. These sutures should be removed within forty-eight hours, and when horsehair stitches are used they should be carefully watched to see that there is no undue dragging, and it should be remembered that stitch-hole scars are often more disfiguring than that resulting from the wound itself. The most suitable dressing is gauze and collodion.

By this method a cure is obtained in ten days, and the resulting scar, if the operation is carefully done, is usually inconspicuous.

Where the lesion is too large for the edges to be brought together, even though the operation be done piecemeal, portions of it can be covered with skin grafts. The resulting scar is, however, seldom pretty, and it is usually best under these conditions to employ one of the other methods of treatment.

Finsen Light unquestionably gives the best results in the large proportion of the cases on the face where for one reason or another excision is inadvisable.

The resulting scar, being thin and supple, is excellent from the cosmetic point of view. The great drawback to the treatment is the length of time required to produce a cure. A patch the size of a five-shilling piece will take in most cases from six to twelve months to cure, and even then the case will probably show slight recurrences from time to time, which will require further treatment. Where time is no object, however, it is the ideal method.

As regards the apparatus, where there are plenty of cases in a large hospital, it is advisable to instal the large arc lamp, from which four cases can be treated simultaneously. In most hospitals, however, one of the smaller modifications is all that is necessary. The most satisfactory is the Finsen-Reyn lamp, which is supplied on a convenient adjustable stand. The lenses are made of quartz to allow of the free passage of the ultra-violet rays, and there is a continuous circulation of cold water to keep the lamp cool; the heat rays are eliminated by transmitting the light through a space between the lenses, which is filled with distilled water.

The patient is laid on a couch, the lamp focussed on the patch to be treated, and firm pressure is exerted either by the patient, or a nurse, with a small quartz lens, to squeeze out all the blood from the surrounding tissues. If this is not carefully done the red colour will cut off the ultra-violet light, and prevent penetration to the deeper layers which it is of the utmost importance to secure. The reaction takes place in from twelve to twenty-four hours, when an intense erythema is noticed, and frequently some vesication. The length of exposure varies with the lamp and the patient, but the usual course is to begin with half-hourly exposures, and increase to an hour or more as the case requires it. The reaction goes down in a few days, and the exposure over the same part is repeated until all the nodules have disappeared. There is always a certain amount of pigmentation produced by the treatment, but this is transient, and will disappear in a few weeks. The most suitable application between the exposures is either a calamine lotion or boracic ointment.

There is a more recent lamp, known as the Kromayer or quartz lamp. The lamp consists merely of a U-shaped tube, partly filled with mercury, and the air exhausted, the current being carried by the mercury vapour. The amount of ultra-violet light given off is very great, and is well concentrated, so that the exposures are very much shortened. It is best to begin with three minutes and increase gradually according to the reaction produced. The maximum limit is about six or seven minutes. Pressure must be exerted on the part for the same reason as with the Finsen lamp, only in this case the front of the lamp itself is used. A water supply should be kept running fast, while the lamp is turned on, for cooling purposes. It should be remembered that the use of this lamp requires careful attention, otherwise serious burns, similar in type to X-ray burns, may be produced. It is wise, therefore, to feel one's way by increasing the dose gradually with each patient. It has been stated that the penetration with this lamp is not so good as with the Finsen. As far as the author's experience goes, this is by no means always true; in several cases the two methods have been used on the same patient at different ends of the lesion for purposes of comparison, and sometimes one lamp has proved the better and sometimes the other. When the Kromayer lamp is effectual, the time saved is enormous. A serious drawback is the extreme delicacy of this apparatus, and if broken it is difficult to get it repaired.

X-rays are especially useful when there is ulceration; by their means these cases can be healed very rapidly, much more quickly than with the Finsen light. It is, however, not so satisfactory a method for dealing with the deeper nodules; for this reason the two methods are often used together, X-rays first to heal the ulcer, and Finsen light afterwards to finish the cure. When X-rays alone are used, the scar is not so satisfactory as with light treatment; it is much denser and less supple, liable to show injected venules, even when great care has been exercised, and the pigmentation resulting from the treatment is more permanent than with the Finsen lamp. The latter will, however, frequently improve an

X-ray scar, and is often used for this purpose after all signs of lupus have been removed.

It is better to give the applications in large doses at long intervals than in small frequent doses. The doses should be carefully measured with the Sabouraud-Noiré pastille, the patient being at the regulation distance of 15 centimètres. The most convenient dose to give is a three-quarter full dose, as this can be accurately measured by examining the pastille by an ordinary carbon filament electric light instead of by daylight, as is done to measure the full dose in treating ringworm cases. This three-quarter dose may be repeated at fortnightly intervals, and as long as these conditions are carefully observed there is no danger of a burn. Apart from the accuracy with which the three-quarter dose can be gauged, there is the additional advantage in giving large doses at long intervals that if through any error an overdose has been given, the operator will see signs of trouble before the next exposure is due; whereas with the small multiple doses at short intervals, exposures may be, and sometimes have been, continued after the patient has been burnt, the burn frequently not showing for a week or ten days.

The most suitable application to be used between the exposures is a calamine lotion; hydrogen peroxide fomentations at night from time to time will keep the lesion clean if there is much scabbing. Boracic ointment is apt to be irritating when X-rays are used.

Cauterisation is a rapid and good method of treatment when the disease is not on the face. A fine electro-cautery is better than the usual Paquelin's cautery, as the nodules can be more accurately destroyed. The cauterisation is done at intervals of a month, in order to give time for recovery between the treatments, until all the nodules are destroyed. A local anæsthetic will suffice to prevent the patient suffering much at the time, and for the first few days after stovaine may be added to the boracic ointment (15 gr. to the ℥j) to dress the burn.

Erasion or scraping the diseased patch with a sharp spoon is a fairly efficient method of eradicating the disease, but the resulting scar is not as a rule as good as with the above-mentioned methods. It is best to give a general anæsthetic, and in all probability the operation will have to be repeated two or three times at long intervals, whenever recurrences show themselves.

Scarification or dividing up the diseased patch by numerous incisions made close together is not so certain a method as erasion, but when successful gives an equally good scar. It may be done with either a multiple scalpel or with a single Vidal's knife. The incisions should be made in a criss-cross fashion so as to thoroughly cut up the diseased tissue.

Radium has no selective action upon lupus as it has upon keloids, nævi and rodent ulcer; if used, it must be used in such doses as to destroy. The length of the exposures will, of course, depend on the amount of radium used and the extent to which the rays are filtered. The results compare favourably with the X-ray method, but of course only a small area can be treated at a time.

The treatment by **chemically destructive agents** has rather gone out of fashion with the advent of the newer methods mentioned above, but when the latter are not procurable, good results may be obtained by applying strong ointments, plasters, etc. Some of the more successful are:

Salicylic Acid, either as a 10 per cent. plaster cut out to fit the lesion exactly and replaced with a fresh piece as required, or mixed with glycerine so as to form a thick cream and applied on lint.

Pyrogallic Acid, 10 per cent. in an ointment of soft paraffin, or mixed with salicylic acid, 10 per cent. of each.

Vienna Paste, consisting of equal parts of unslaked lime and caustic potash, made into a paste with spirit immediately before applying.

Hydrarg. Perchlor., ʒj ; Collodion, ad ℥j ; to be painted on.

Silver Nitrate stick drawn firmly over the lesion in all directions is effective but painful. A modification of this, which is known as the "two pencil" method, is extremely useful for lupus spreading inside the nose, as it frequently does in adults. A moistened stick of silver nitrate is first pressed firmly over the diseased area for half a minute, then a stick of metallic zinc is used quickly over the area in the same manner; the caustic effect is excellent, and it is not so painful afterwards as the silver nitrate used alone.

It should not be forgotten that the scarring produced by these chemical caustics is very tough, and renders subsequent treatment, should it be necessary, by light or X-rays very much more difficult.

Ionisation, whether with zinc or copper, on the surface does not penetrate far enough in the majority of cases to produce a cure; even when needles of the metals are inserted into the tissues the results are not very satisfactory.

Vaccine Therapy by tuberculin, either by injection or by the mouth, is rarely completely successful in lupus; in many cases it has no effect at all, probably due to the absence of blood-vessels in a lupus nodule. It may be useful, however, in combination with other treatment.

OTHER TUBERCULIDES.

In addition to lupus there are several other varieties of tuberculosis of the skin, of which the treatment is in some cases important, in others trivial, as compared with the general condition of which they are a manifestation. In the more serious varieties, tubercle bacilli are present in the lesions on the skin, in the others the real focus is internal, the rash on the surface being spoken of as a toxy-tuberculide, there being no organisms present there. The general treatment of tuberculosis is therefore important in all cases, and is described elsewhere; but it is the local treatment of each variety with which we are specially concerned here.

Acne Scrofulosorum (Synonyms: Acneiform Tuberculide, Acnitis, Papulo-necrotic Tuberculide) is best treated by exposures to X-rays as described above, and by applications of sulphur and mercurial ointments, of which the following will be found useful: Sulph. Precip., gr. 15; Hydrarg. Sulphidi Rub., gr. 10; Adipem Benzoatum, ad ℥j.

If the lesions become irritated with this after some time, they should be soothed by using an ichthyol cream as follows: Ichthyol, gr. 30; Zinci Oxidi, ʒvss; Adipis Lanæ Hydrosi, ʒij; Ol. Olivæ, Liq. Calcis, āā ℥j. By these means the condition can usually be healed in three weeks or less, but there is often permanent scarring.

Bazin's Disease, or **Erythema Induratum,** is treated in a similar manner to the above; as it has a deeper origin it usually takes longer to heal.

Lichen Scrofulosorum is not of much importance in itself, but occasionally the spiny plugs are irritating, in which case they may be treated with salicylic acid and tars as follows: Acid. Salicylici, partes 2; Ol. Cadini, partes 10; Resorcin., Ichthyol., āā pars 1; Adipis Benzoati, partes 30. Fiat Ung.

Angiokeratoma is not universally accepted as a tuberculide, but the evidence appears to be rather for than against. It is best treated by destroying with negative electrolysis (*see* Nævi) or by the electro-cautery.

Folliclis is of little importance, and as it usually accompanies chilblains, treatment is generally devoted to the latter; the ichthyol cream given above will, however, be found useful for it.

Pityriasis Rubra Gravis of Hebra is a very rare form of generalised tuberculosis, and beyond making the skin as comfortable as possible, there is no local treatment. Weakly carbolised olive oil has been found to be of use, and should be rubbed in gently.

Anatomical Wart, or **Post-mortem Wart**, if it cannot be conveniently excised, must be destroyed by other means, of which the best are: The actual cautery under a local anæsthetic, or a combined pyrogallic and salicylic acid ointment, 10 per cent. of each, with or without scraping. The X-rays also are often successful, especially if the horny matter is removed first by chemical means.

The **papulo-squamous tuberculide** or **tuberculous psoriasis** reacts well to X-rays as a rule, and to the salicylic acid and oil of Cade ointment given above under Lichen Scrofulosorum. It tends, however, to recur. Chrysarobin often irritates it too much.

The so-called gummatous tuberculosis, strumous ulcer, or tuberculous lymphangitis is treated like lupus, the best results, as a rule, being obtained by scraping or excision.

Scrofuloderma is also treated similarly to lupus, but as a rule the results are slower, as the whole process starts deeper and therefore penetration in light treatment is more difficult to obtain; also, as most of the lesions occur on the neck, it is difficult to apply suitable pressure in order to compress out the blood.

Multiple Benign Sarcoid of Boeck is in all probability a tuberculide. The administration of arsenic by the mouth sometimes causes the nodules to disappear completely, and generally leads to improvement. The local treatment is symptomatic.

Lupus Erythematosus is considered elsewhere, as the tubercle toxin is only one of many which can produce it.

WILFRID S. FOX.

TYLOSIS.

In all cases one must first be certain that there is no specific mischief. This may give rise to either a uni-lateral or a bi-lateral affection, in which, of course, mercury and iodide are of most use.

In ordinary types internal medicines are of little value, and in this connection it is well to remember that the prolonged administration of arsenic will itself produce a hyperkeratosis.

Boracic starch poultices changed four hourly, and scraping with pumice stone before each fresh application, is probably the best primary treatment. A paste of fuller's earth and water, or its purer preparation, "Emol keleet," is also a very good remedy, and is used similarly. Later the application of 10 per cent. to 20 per cent. of salicylic acid in plaster or ointment should be used. The progress may be hastened by daily soaking in 5 per cent. of carbonate of soda for fifteen to thirty minutes, but one must beware of setting up a dermatitis by persisting in this too long or using too strong a solution.

The last stage is most important, as after the thickened epithelium is removed there is still an impaired condition of the blood vessels and a tendency to reaction to irritants. This can be removed by a course of tar (*see* Eczema).

F. GARDINER.

URTICARIA (ANGIONEUROTIC ŒDEMA, LICHEN URTICATIS URTICARIA PIGMENTOSA).

The first line of treatment in this common complaint, whether in children or adults, is to eliminate those articles in the diet which are found in each particular individual to irritate his gastro-intestinal mucous membrane and thus produce these reflex skin lesions. The foods which produce this irritation appear to differ considerably in each case; at the same time there are a large number which are common to all, which perhaps it would be as well to enumerate. It should not be forgotten that articles of diet may irritate not only by their toxic effects, but also purely mechanically. For the latter reason anything which leaves an indigestible residue, especially in the shape of hard seeds, husks, or whole grain, should be avoided in the diet. Under this heading come all the seed fruits, porridge, brown bread, and insufficiently boiled rice. Of the foods which are apt to produce a toxic effect the commonest are all varieties of shell fish, and in some instances fish of all kinds, although most patients are able to assimilate soles and whiting satisfactorily, especially if cooked in a plain manner. Whiting is, however, occasionally found to cause the disease, because the fishmonger is apt to substitute small haddock when whiting is scarce, the haddock being a very common cause of urticaria in many people. The large group of ptomaine poisons are a frequent cause, and for that reason the patient should always be careful to take all food as fresh as possible. Mushrooms are in some people an inevitable cause of urticaria; again, in others any fruit, apart altogether from the seed fruits, appears to irritate the mucous membrane; in some cases a single grape is sufficient. External irritants should also be remembered as being able to cause urticaria in susceptible individuals—*e.g.*, jelly fish, hairy caterpillars, some plants such as the primula obconica, the hybiscus, leaves of the tomato, the poison ivy of America (*Rhus toxicodhendron*), although this latter causes an eruption which is more often vesicular than urticarial in its character. In treating a case, therefore, the practitioner must investigate the particular cause in his case and protect the patient from it. The food must be of a bland, non-irritating character and somewhat sparing in amount. The question of eliminating sugar from the diet is held to be very important by some authorities, but the more modern view appears to be that sugar itself is harmless, and that those cases which occur always after eating sweets are due either to some indigestible substance, like nuts, or some impurity in the sweets. The clothing next to the skin should be smooth and non-irritating; at the same time the patient should be warmly clad, as a great many of those who suffer from recurring attacks of urticaria find that the attacks frequently follow exposure or chill.

The patient should be given a purgative, preferably of the saline type, and in acute cases following on some special indiscretion of diet it is advisable to give a 4 gr. blue pill four hours before the saline. Other drugs which may be useful internally are calcium salts, usually in the shape of calcium lactate in 10 gr. doses three times a day for two days, then omitted for two days and continued in this manner intermittently if any benefit results. In many cases, however, instead of there being a diminished coagulability of the blood and the urticaria being simply a serous hæmorrhage, the blood is actually found to be above the normal in this respect. In those cases where the urticaria appears to be due to chronic irritability of the large intestine, a mild course of lactic acid bacilli is frequently efficacious. The writer has found the Metchnikoff lacto-bacilline tablets better, although, of course, they are not so active as the freshly-prepared milk. Again, pathological growth of coli bacillus, especially in other parts of the body than their normal habitation, may be a cause of chronic urticaria, and where this has been found, a course of vaccine treatment with that organism is indicated. Dr. Spitta, in a series of cases in which the cause of the urticaria appeared to be obscure, has found the bacilli present in the bladder, and procured excellent results by vaccine treatment.

Locally anti-pruritic remedies should be applied. In most cases acids are more effective in this than alkalies, of course excepting those cases in which the urticaria is due to the acid bites of insects or other external irritation. In children a 1 in 80 carbolic lotion, which should be dabbed on freely, is generally effective, and has the advantage of not smarting and making them dread the application; while the skin is still moist with this lotion, it should be powdered thickly with equal parts of boracic acid and zinc oxide. In some, weak acetic acid is often very effective, as in the shape of ordinary household vinegar. In adults it is generally better to put the powder and the lotion together as follows: ℞. Liquor. Picis Carbonis, ʒss; Calaminæ, Zinci Oxidi, āā gr. 15; Glycerini Plumbi Subacetatis, ʒv; Glycerini, ʒss; Aquam Rosæ, ad ℥j. Ichthyol painted on locally, in the strength of a drachm to the ounce of water, is also very soothing when the itching is intense.

Urticaria pigmentosa tends to disappear of its own accord as the child approaches adult life, more especially if the general health improves. There is no general or local treatment that can be relied upon to have much effect on the condition, although belladonna has been advised. It is, therefore, best to give the child tonics of iron and phosphates, cod-liver oil and malt, etc. When the itching is marked it may be relieved as in ordinary urticaria.

WILFRID S. FOX.

WARTS (VERRUCÆ).

THE only drug taken internally which has any effect on this condition is magnesium sulphate. It is by no means always successful, but it is certainly advisable, especially in the case of children, to give this in addition to local treatment. It should be given in 5 to 10 gr. doses three times a day in the case of young children, and 20 to 30 gr. in the case of adults. There is no question that in some cases it is possible to cure warts by this internal administration alone.

Externally, innumerable methods have been used for the destruction of warts. The most suitable for any particular case will depend on the position on the body and also on the hardness of the horny layer over the wart. In the case of the soft, flat, multiple warts occurring on the face and hands of children a salicylic acid cream is generally all that is necessary. The following prescription may be found useful: Acidi Salicylici, gr. 20; Zinci Oxidi, ʒvj; Adipis Lanæ Hydrosi, ʒij; Olei Olivæ, Liquoris Calcis, āā ℥j. This should be rubbed well over the warts twice daily, and when they are situated on the hands the child should wear gloves. When the warts are more horny in character, stronger measures should be used. There is no doubt that the surest and quickest method of removing the hard horny wart is by the electric cautery. This should be done under a local anæsthetic, preferably novocaine and adrenalin injected under the wart or group of warts. The centre is then destroyed by a fine electro-cautery. The skin should be well cleaned up beforehand with ether and hydrarg. biniodide lotion, the latter being also used freely after cauterisation. A dressing of collodion can then safely be applied, or, if a large number have been treated, it is safer to use boracic powder and dry gauze.

Negative electrolysis is also a quite satisfactory method, and should be carried out in the manner described under Nævi and Moles, the needle on the negative pole being pushed in at various angles so as to completely destroy the whole wart.

Solid carbon dioxide is also a fairly satisfactory and painless method of treatment, and is therefore suitable for children, what pain there is coming on after the operation is over. The mode of procedure is described in the article on Nævi, the only variation being that in the case of warts, especially when there is an excess of horny matter, the exposures must be very much longer in duration, usually forty-five seconds to one minute or more. The whole wart will separate in the course of a few days from the skin below, coming away on the top of a blister, which is frequently hæmorrhagic. A smooth, flat surface is then left, which heals quite satisfactorily in the course of a week or ten days. The risks of this method are that one may overstep the mark and produce definite ulceration, which not only takes some time to heal but also leaves a scar. In addition, in people who are very prone to warts, the practitioner may produce a ring of warty growth around the edge of the area treated, although the wart in the centre has been satisfactorily removed. The writer has seen this occur on two occasions. After the operation the area treated is best covered with dry gauze and boracic powder.

The method of ionisation of warts with magnesium from a solution of magnesium sulphate is successful in a case of soft warts, but is, as a rule, useless in dealing with the more horny varieties, and as these soft warts are usually easily curable by less elaborate means, this method does not hold any great position in the treatment.

X-rays are also a satisfactory method of treating warts, and have the advantage of being quite painless and free from danger if given in large doses at long intervals, that is to say, three-quarter Sabouraud doses once a fortnight (*see* X-Ray Treatment in Diseases of the Skin). The drawback to this method of treatment is that the warts occasionally recur. The writer recollects one case in which a large number of warts on the backs of both hands were entirely removed by one three-quarter exposure of X-rays. The skin remained perfectly normal for two months and then all the warts grew again in the same situation as before. They were again removed with X-rays and again, after an interval, reappeared. Finally the case was permanently cured by the electro-cautery.

In addition to the salicylic acid cream referred to above, the other chemical preparations which will be found to be of use are salicylic acid in collodion (a drachm to the ounce), painted on fresh twice daily; glacial acetic acid, to be put on with a pointed wooden match; a paste consisting of equal parts of resorcin, glacial acetic acid and precipitated sulphur, to be put on with a match on the wart only; chromic acid, in the shape of the official liquor [U.S.P. 25 per cent.], to be painted on twice daily; acid nitrate of mercury, although this is usually much more painful to apply than any of the preceding.

Senile warts (so-called seborrhœic warts), which are subject to irritation or show any signs of bleeding or ulceration, should always be removed by excision rather than by destruction with chemical or electrical cauteries, as this will allow the practitioner to have a microscopical examination made to see whether the lesion is innocent or of a malignant character, which will act as a guide to him in the event of recurrences in the future. Excision in children or young adults is hardly ever advisable.

WILFRID S. FOX.

VITILIGO.

WHILE it is rarely that one can obtain a cure in this complaint, yet one can mitigate the effects. Generally regarded as a neurosis, my best results have been obtained by working on the toxic theory. Baths of Condy's fluid, which stain slightly, internal antiseptics, such as salol and beta-naphthol, mineral waters, and later some quinine preparation, have given me most satisfaction, and have been followed by cure in one case. Duhring considers that arsenic is our best remedy. With a view to producing a reaction, galvanism and faradism applied by means of a tinsel brush are used by some. Painting with weak iodine, blistering, and painting with pure carbolic acid are recommended, the last by Savill.

Often one has to use a brown stain, such as walnut juice, to disguise the condition.

In some sufferers I have seen the onset of winter coincide with an improvement.

F. GARDINER.

XANTHOMA.

THE situation in which this disease commonly occurs, namely, around the eyes, renders treatment somewhat difficult, it being very important not to do anything which might cause distortion of the eyelids and ectropion. When the lesions are very small, excision is quite satisfactory, as the linear scar which results is usually hidden in the folds of the eyelid. Care must be taken not to incise too deeply, especially on the lower lid near the inner canthus.

When the condition is too extensive for excision careful burning with the electro-cautery is the most satisfactory treatment. It should be done under a local anæsthetic, and in order to prevent the cautery burning too deeply it is advisable to use it in two or three sittings. When the tubercles are situated on the hands, elbows, or knees, the above methods may be used rather more thoroughly, or the nodules can be removed by scraping with a sharp spoon, or by electrolysis. For the latter it is generally necessary to have a multiple needle attached to the negative pole, and a current of 2 milliampères passed through each needle. Salicylic acid in collodion (1 drachm to the ounce) may also be of assistance for these larger nodules.

Xanthoma Diabeticorum.—This condition, being essentially a manifestation of diabetes and in no way a distinct skin disease, reacts to the treatment of that disease. It will be found that as the patient improves upon the special diet the rash will tend to disappear. Arsenic, from its tonic effect, is said to be helpful in some cases. Locally, to allay the pruritus when present, weak carbolic lotion (1 in 60), followed by a dusting powder of zinc oxide and boracic acid (equal parts), is all that is necessary. As an alternative, liq. picis carbonis (♏10) in calamine lotion (℥j) is also effective in stopping the irritation.

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XERODERMA.

(*See* Ichthyosis, p. 1053.)

X-RAY DERMATITIS.

The treatment of the acute variety and that of the chronic being so different, it is better to consider them separately.

The **Acute X-ray Dermatitis** which is usually seen in the patient rather than in the operator is due either to an excessive overdose, or to several smaller doses given so close together that an insufficient time has elapsed to allow the skin to recover between each. The resulting ulcer, if left to itself, will take months or years to heal, according to the amount of overdose. The treatment should be of such a nature as to keep the ulcer as free from organisms as possible without using strong antiseptics and without allowing the tissues around to get hard. The most suitable dressings are those substances which give off oxygen as they are reduced by the tissues, and leave an inert non-irritating body behind. The best of these bodies are peroxide of hydrogen, peroxide of zinc, permanganate of potash, and occasionally potassium chlorate. Peroxide of hydrogen is applied in the form of fomentations of 5 or 10 vols. in strength; these should be renewed every four hours. In this way the ulcer is kept beautifully clean; but when continued for more than a few days at a time it is apt to render the surrounding tissues hard and prevent the healing processes. The advantage of peroxide of zinc, ZnO_2, is that, being a powder, it can be made up into an ointment as follows: ℞. Zinci Peroxidi, ʒj; Olei Olivæ, ʒij; Adipem Benzoatum, ad ℥j. This should be spread on lint and bandaged over the ulcer. The dressings should be changed twice daily. This is an extremely useful preparation to alternate with the fomentation, as it softens the tissues, and at the same time keeps the ulcer clean. Once the slough has been removed and the base looks fairly healthy, an attempt should be made to skin-graft. This is best done in large flakes about the size of a two-shilling piece. An anæsthetic is usually necessary, and a suitable site having been selected on the arm, or elsewhere, the flake of skin is taken off with a sharp razor, preferably not hollow ground, the razor going just deep enough to make blood ooze from the skin below. The flakes of skin should be floated in normal saline at the temperature of the body, carefully unrolled, and spread gently over the ulcer, care being taken to put them the right way up; the wound is then covered with green protective dipped in saline, and a firm bandage applied. The ulcer should be left untouched as long as it feels comfortable; but, as a rule, in these cases after five or six days the patient begins to complain of the dull ache which is always so marked a symptom in all X-ray burns. As a rule in examining the ulcer a thin glairy purulent discharge will be found under the green protective. This does not mean necessarily that the skin-graft has been a failure, but is evidence of the extremely low resistance of the tissues to organisms. The wound should be gently syringed first with peroxide of hydrogen and then with normal saline, and fresh green protective applied. At the end of ten days of this treatment one can judge as to how far the skin-grafts have taken; and even if there has been no success in the grafting, it will often be found that the edges have been stimulated by the process and are making some effort to heal. It is usually necessary to repeat this skin-grafting several times before one gets the ulcer entirely covered.

When permanganate of potash is used it should be applied in the shape of fomentations of a very weak solution (0·5 per cent.). Potassium chlorate, on the other hand, may be used in an ointment 15 gr. to the ounce. One of the characteristics of an X-ray burn is that the tissues seem to do very well on an application for a week or so and then get tired of it, so that the case should be carefully watched and the treatment changed as the ulcer indicates. The average length of time required to get an ulcer of any size healed is anything from twelve months to two years. In those cases in which the base seems quite inert and there are no granulations, it is advisable to scrape the ulcer thoroughly. In doing this it is necessary to penetrate the deep fascia and expose tissue which has a different inervation, the suggested theory being that the nerves ending in the skin and subcutaneous tissue are damaged by the X-rays, and that from the want of trophic impulses there is neither attempt at healing nor resistance to pyogenic organisms. Granulations of a poor type may appear time after time, only to be slowly dissolved away in a thin purulent discharge. It is in these cases particularly that the deep scraping is required, and as a rule it will be found that healthy granulations will spring up from the subjacent muscle and either grow into a firm scar of their own accord, or else take skin-grafts. It is surprising how the depth of the wound fills up and flattens out.

In burns due to an overdose in ringworm cases the best treatment is lint soaked in olive oil, unless the scalp is dirty, in which case peroxide of hydrogen fomentations should be used; in these cases, however, although the skin may heal, the outlook as regards regrowth of hair is very bad.

In those rare instances in which the whole of the X-ray ulcer can be excised and the edges brought together this should be done, as the time of healing will be considerably shortened thereby.

There is frequently a good deal of eczematoid irritation around an X-ray ulcer, and this can be soothed by the application of a mild ichthyol cream composed as follows: ℞. Ichthyol, gr. 15; Zinci Oxidi, ʒiv; Adipis Lanæ Hydrosi, ʒiijss; Olei Olivæ, Liquoris Calcis, āā ℥j. This is not, however, a suitable dressing for the ulcer itself, which is apt to be infected.

Later on, when the ulcer is healed, there is often considerable irritation in the scar and the surrounding skin, more especially if it is situated on the lower limbs. The ichthyol cream given above may help, but very often all that is required is a protective varnish, of which there are several good ones to select from. The writer has found pellanthum very satisfactory, also vernisol and traumaticin. This will, in all probability, have to be continued for several years.

The treatment of **chronic X-ray dermatitis** in the operator is still more unsatisfactory than that of the acute. Very little can be done to relieve the continuous pain which is felt both around the nails and in the bones. When there is any vesication or ulceration, the same treatment may be tried as in the acute burns; but later on, when it is a question of dealing with injected scars and warty growths, other means must be resorted to. One patient who was under the writer's care, a medical man, obtained considerable relief from the pain in the skin by dressings of plain weak alcohol, repeated at frequent intervals; this enabled him to get some sleep at night, which could otherwise only be procured by the aid of morphia. Some relief, strange to say, can be had sometimes by giving one fairly large X-ray exposure over the part; it is best to use the three-quarter dose carefully measured with the Sabouraud pastille. Radium also may be very useful, especially for the hard, cornified, warty growths. However, it is usually only a question of time before operative measures in the shape of amputation become necessary, if only to relieve the pain. It is advisable not to leave this too late, since the affected areas may become epitheliomatous.

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DENTAL SURGERY.

Dental Surgery forms a very distinct department of surgery which requires special training and is practised almost exclusively by dentists, but it is desirable that the general principles of treatment should be understood by the medical practitioner. With the recognition of the close relationship that exists between dental and other disease, there has naturally occurred a more frequent collaboration between the medical man and the dentist, which is or should be beneficial to the patient. But it sometimes happens that the patient is advised to go to a dentist to obtain certain specified treatment which does not commend itself to the dentist as being the best; and apart from the merits of the particular treatment desired the dentist may not unnaturally feel that he is being instructed in his own work by one who knows less about it. Such friction should never arise; the dentist should defer to the medical man on questions of general health supposed to be due to dental disease, but the doctor should never prescribe particular forms of dental treatment without consultation with the dentist. It is probably true that when such a course is taken and the dentist disagrees, the medical man is usually wrong, although it may be

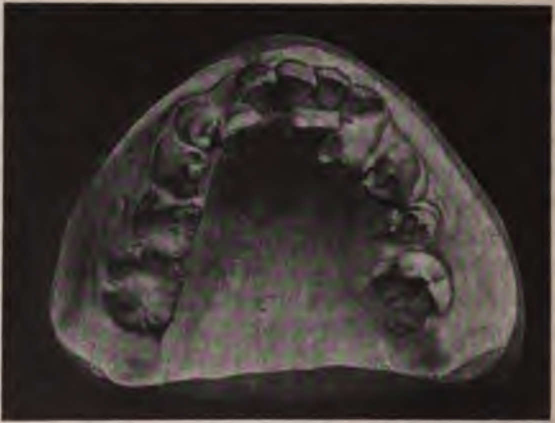


FIG. 1.—Deflection of permanent lower incisors by retained deciduous incisors.

admitted that the dentist of to-day is apt to be somewhat too conservative in his treatment, and to forget the patient in his concentration on the teeth. A more extensive knowledge on the part of general practitioners of the causes of malformation of the jaws, and abnormalities of position and diseases of the teeth, and of the possibilities of modern treatment, would go far to prevent misunderstanding and would react for the benefit of the patient. The chief purpose of this article is to acquaint the medical man with the principles and *rationale* of treatment of the teeth.

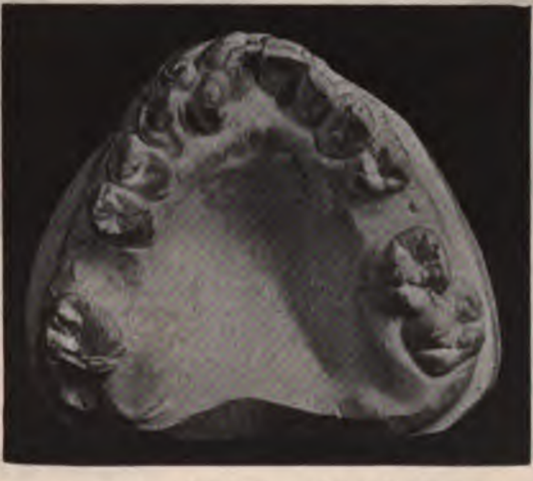


FIG. 2.—Deflection of right upper latent incisor by supernumerary tooth.

ABNORMALITIES OF POSITION OF THE TEETH AND ABNORMAL DEVELOPMENT OF THE JAWS.

The so-called irregularities of the permanent teeth may be due (1) to local causes such as undue retention of the deciduous teeth, thumb sucking, or the presence of supernumeraries; (2) to the premature loss of the deciduous molars, allowing forward translation of the permanent molars and consequent diminution of space anteriorly; or (3) to developmental defects of bony development associated with contracted arches, high-vaulted palate, and retrusion of the mandible. It does not come within the scope of this article to discuss these in detail, but mention of them is necessary to emphasise the importance of prophylaxis.

As regards the first class, it is plainly of importance that evil habits of thumb or finger sucking should be cured, and that if the deciduous teeth are not shed at the normal periods the dentist should be consulted. Those periods are not constant, and vary to some extent in different children in association with other phenomena of growth and development. Undue retention (Fig. 1) is by no means as harmful as premature loss, but if the deciduous teeth remain in position much beyond their proper time they should usually be removed. Certain exceptions occur when, for instance, a permanent successor is so misplaced in its crypt as to be prevented from subsequently erupting. Supernumerary teeth (Fig. 2) should

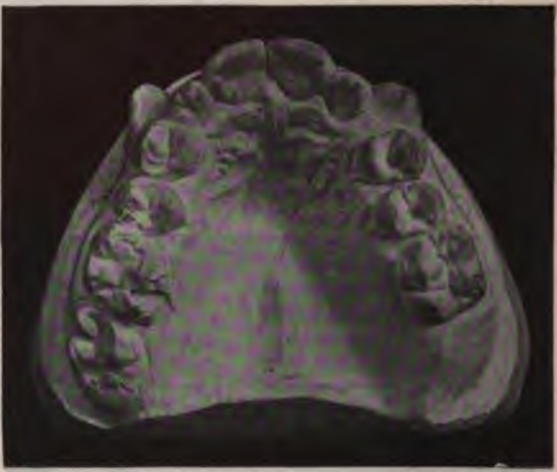


FIG. 3.—Deflection of permanent upper canines caused primarily by premature loss of deciduous molars, allowing forward translation of permanent molars and premolars.

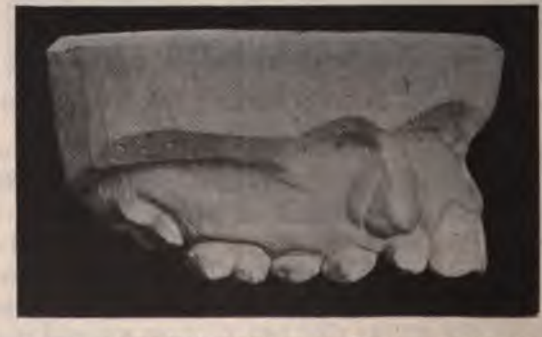


FIG. 4.—Same as Fig. 3, showing side view of right side.

lly be removed, but it is not always easy to determine which ı is a supernumerary, and a dental surgeon should be cond. A radiograph is useful in case of difficulty.

ith regard to the second class, premature extraction of the luous teeth is of course usually occasioned by caries. The ıs of prevention of the caries will be discussed later, but the ent problem is to define the extent of disease that justifies or ires removal of a temporary tooth or teeth. Suppuration ed by death of the pulp should always involve extraction. sure or death of the pulp does not necessarily mean that the ı must be lost, but often does. Extencaries not reaching ulp can and should ly always be remedied reatment. The use trate of silver is very able in inhibiting s in an early stage, cavities can be filled, removal of carious ael and dentine, with ent, gutta-percha, or lgam. A condition d "arrested caries" ı occurs in deciduous ı, in which, owing to hange of diet or ronment of the child, process of caries in several teeth stops, and the carious ces, even though discoloured and more or less denuded aamel, become hard and polished. This condition is seldom gnised by medical men, who condemn such teeth when they useful members and perfectly harmless from the point of view ing a source of sepsis.

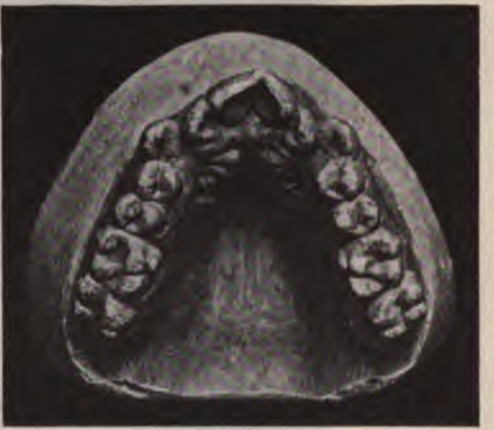


FIG. 5. — So-called V-shaped arch. Deficient development of premaxillæ and anterior portion of maxillæ.

me difference exists as to the efforts that should be made to erve deciduous teeth, in connection with the position in the th that they occupy. Carious incisors may be sacrificed with likelihood of harmful results than in the case of molars. The molars are less important than the second. The canines are able to preserve the space for the large permanent canines, but most important deciduous teeth are the second molars, not only ccount of their value in mastication, but because of their passive function in preventing forward movement of the first permanent molars (Figs. 3 and 4). Speaking generally, it may be said that any tooth that cannot be made clean and functional, and certainly any that is a source of suppuration, however slight, should be removed, because any ill effects on the subsequent arrangement of the permanent teeth, and even the loss of masticating area, are of less consequence than the immediate harm to the child from the absorption or ingestion of septic material by the lymph channels or alimentary canal respectively.

The third class (Figs. 5 and 6) includes a large variety of conditions in which irregular alignment of the teeth in either jaw and abnormal occlusion of the two arches are for the most part secondary to defective development of the maxilla and mandible and other bones of the face; many of these cases are associated with adenoids, and enlarged tonsils, and mouth-breathing. Such abnormal forms of jaws are sometimes inherited, but inasmuch as the chief cause of these conditions is the same as that of caries of the deciduous teeth, namely, improper diet during the first few years of life, the methods of preventive treatment will be considered later. The frequent use of the rubber teat, apart from its sometimes necessary use in bottle-feeding, is also a cause of misshapen jaws and a contracted palate. Improperly managed bottle-feeding may also be harmful on account of the small size and compressibility of the rubber teat used, and the varying degrees of suction force required by the infant as compared with breast-feeding.

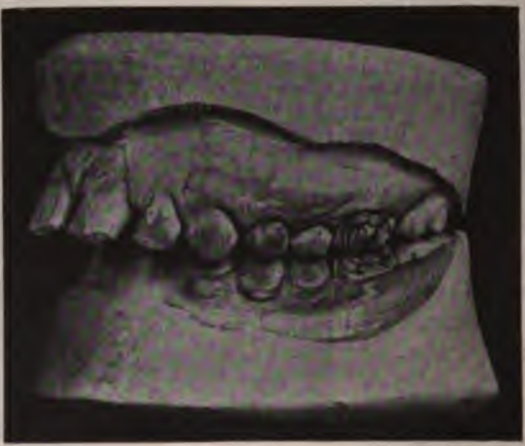


FIG. 6.—Abnormal occlusion of upper and lower arches (first permanent molars marked on model). Retrusion of lower arch and secondary protrusion of upper incisors.

he active treatment of abnormal alignment and occlusion of the h is required not merely for æsthetic reasons, though these

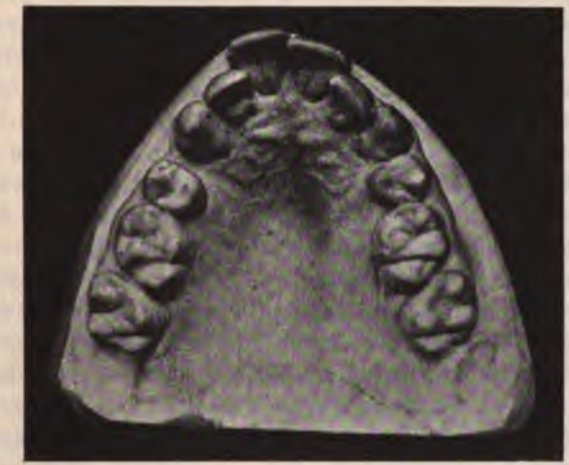


FIG. 7.—Narrow upper arch and protrusion of upper incisors.

worth much consideration. Irregularity conduces to caries. tain forms of abnormal occlusion encourage mouth-breathing and

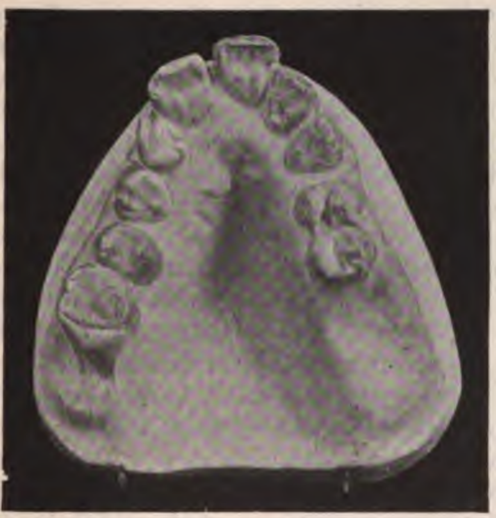


FIG. 8.—Very contracted arch, commonly associated with adenoids.

equent inflammation of the gums and other evil effects. Con-ted arches and high-vaulted palates (Figs. 7 and 8), often associated with adenoids, are themselves a direct cause of recurrence of adenoids after removal. Mechanical widening of the arch or arches should follow removal of adenoids on the principle of abolishing the cause, or at least one cause, of the naso-pharyngeal disease. Close co-operation between the rhinologist and the dentist in these cases is less frequent than it should be.

Treatment may be surgical or mechanical or both. A large number of cases of abnormality can, and should, be remedied without extraction of sound permanent teeth; in others extraction is necessary, and the exact course of treatment must be decided by the dentist. Appliances used may be of the nature of removable plates; or fixed apparatus of delicately made wire arches, screws, springs and ligatures, cemented and wired to the teeth. Such apparatus may be adopted with but little interference with the child's comfort, mastication, or speech, and it need not damage the teeth or cause caries if properly attended to, but certain classes of children of delicate constitution are not fit subjects for prolonged or elaborate courses of treatment.

HYGIENE OF THE MOUTH.

Dental caries is primarily the result of lactic acid fermentation of carbohydrates remaining about the teeth after meals. It is especially a disease of childhood, and the chief cause is improper methods of feeding during the early years from infancy till about five or six years of age. It is very curious that while a natural method of feeding, or the best artificial approximation, is so strongly insisted on during the first six or nine months of life, the most unnatural methods are often recommended for the immediately succeeding years. Correct methods of feeding constitute the best preventive treatment of dental caries, and the order of eruption of the teeth is a convenient guide to changes in diet. After the eruption of the lower central incisors, at the age of about seven months, the saliva is capable of converting starch, and farinaceous food may be added to the milk diet. Large pieces of leathery crust should be given for the infant to gnaw at, care being taken that pieces do not break off, although as a rule an infant will not attempt to swallow any but the smallest and softest bits. With the eruption of the four upper incisors, at about eight to twelve months, the quantity of farinaceous food may be increased and meat jelly may be given. The eruption of the first molars (and lower lateral incisors), at about twelve to fifteen months, marks a very definite epoch in the development of the masticating apparatus. By this time the desire to suck should have been almost supplanted by the desire to chew, and the child should be given bread and butter, dry biscuits, potato broken up in gravy but not mashed, boiled egg, sugar, fruit juice and pulp, baked apple. A child should not be given meat until it has acquired the habit of mastication, but when it is given, at about eighteen months, it should only be cut up into pieces of convenient size, and *not minced*. Fish with the bones carefully excluded, *e.g.*, filleted plaice, is also good. At the age of about two and a half to three years, with the eruption of the second molars, a child's dentition is complete, and it possesses a masticating area at least as large in proportion to body weight as that of an adult. The teeth are there to be used and the child should be fed on all the ordinary articles of diet, only rich foods, sauces, prepared gravies, spiced and preserved foods, and stimulants being excluded. The chief point is that the fibrinous constituents should not be removed; brown bread is better than white, and bread made from stone-milled flour usually better than that from roller-milled. Food and drink should be given separately, not mixed together. Fruit is good, and raw apples, ripe and in good condition, may be given after about three years of age. In this way the teeth are kept clean by the natural process, mastication, and caries is almost, if not entirely, prevented. The method, so frequently recommended, of feeding children up to five and six years of age on soft sloppy foods, mashed potatoes, and minced meat, is unscientific and harmful, and can hardly be too strongly condemned.

Children of three years of age or less may be easily taught to use a tooth-brush as an additional safeguard. Plain water is sufficient, but the addition of a small quantity of pleasantly flavoured tooth cream forms an extra incentive. The most important time for use is the last thing before bed.

In later years and in adult life the tooth-brush should be used night and morning. It should be small with rather stiff bristles widely set in groups, not packed closely together with an even surface like a clothes-brush. A suitable tooth powder is as follows: ℞. Saponis Hisp., Pulv. Iridis., āā ʒij; Cretæ Precip., Mag. Carb. Pond., āā ℥ij; Ol. Eucalypt., Ott. Rosæ, āā ♏8, Fiat Dentifrice.

Other powders or creams may be used, the chief ingredients being something finely gritty, something saponaceous, and an antiseptic and a flavouring agent.

Inasmuch as dental caries is caused by lactic acid fermentations of bacterial origin, alkaline and antiseptic mouth washes are beneficial, such as: ℞. Sodii Bicarb. gr. 15; Sodii Chlorid. gr. 10;

Sodii Salicyl., gr. 1 ; Thymol, Menthol, āā gr. ¼ ; Glyc. Boracis, ʒj ; Aq. Thymol (saturated aqueous solution of Thymol) ad ℥j. Misce. *Sig.* Use one part in four parts of water. ℞. Tinct. Krameriae, ʒjss ; Acid. Benzoic., gr. 3 ; Glusidi, gr. 8 ; Ol. Menth. Pip., Ol. Cinnamom., āā ♏2 ; Alcohol 90 %, ad ℥j. Misce. *Sig.* Use 30 drops in half a tumbler of water (Miller). ℞. Creolin., ♏15 ; Formalin., ʒj ; Ol. Gaulth., Ol. Bergam., āā ♏5 ; Spt. Chlorof. ad ℥j. Misce. *Sig.* Use a few drops in half a tumbler of water.

The accumulation of tartar about the lower incisors and upper molars is a source of sepsis and it should be periodically removed; the necessary frequency varies much with different people.

DENTAL CARIES.

In its initial stages this process consists in decalcification of enamel; after the enamel has been penetrated the dentine is also decalcified and the organic matrix is digested by a bacterial peptonising process which spreads rapidly under the enamel, so that a small cavity in the enamel often leads to a much larger one within. The question of involvement of the pulp will be considered later.

Treatment of cavities consists in: (1) Removal of overhanging walls of partly decalcified and weakened enamel by means of hand chisels, and burrs in the dental engine; (2) removal of decalcified dentine by means of hand instruments (excavators); (3) disinfection of dentine; (4) shaping of the cavity to ensure retention of a filling; (5) insertion of a filling, and restoration of the tooth to its original form and (in certain positions) contact with an adjoining tooth.

By the use of sharp instruments and proper use of obtundents these processes, though unpleasant, by reason of jarring and transmission of sound through the bones, should hardly ever be more than a little painful.

Various materials are used for filling teeth, such as gold; amalgams of silver, tin, and mercury, or copper and mercury; cements of oxyphosphate of zinc or copper, or silicate cements; porcelain, shaped or fused to fit the cavity and fixed with cement; and gutta-percha.

The qualities of a good filling material are that it should (1) not irritate the pulp; (2) be adaptable to complex forms of surface and exclude moisture; (3) bear the stress of mastication; (4) not be unduly affected by chemical action; (5) maintain its form; (6) not discolour the tooth.

Considerable judgment on the part of the dentist is necessary for the selection of the appropriate material in different cases, and much skill in manipulation.

DISEASES OF THE PULP.

As soon as caries extends to the pulp septic infection and inflammation take place, accompanied usually by great but intermittent pain, which may be located by the patient in the tooth itself or in the opposing tooth or in another tooth in the same jaw on the same side, but not usually in the endings of more distant branches of the fifth nerve.

Palliative treatment consists in the application of warm oil of cloves or pure carbolic acid, either of which will often abolish the pain almost at once; a small pledget of cotton-wool soaked in carbolic acid may be left in the cavity and protected by another piece of wool soaked in mastic or sandarach varnish. In the case of a small and recent exposure, when the infection is slight and the pain has not been prolonged, antiseptic and sedative treatment may allay the inflammation, and the exposure can be capped with an innocuous material, and the cavity in the tooth filled.

In more severe cases the pulp must be devitalised. This may be done in one of three ways: (1) By the application of about $\frac{1}{16}$ gr. of arsenious acid (together with morphia) sealed in without pressure, and allowed to remain for at least twenty-four hours and not more than a week (a second application is often necessary); (2) by anæsthetisation with cocaine under pressure and removal with instruments; (3) by removal under general anæsthesia with nitrous oxide gas.

After devitalisation the pulp is removed from the central pulp chamber and the root-canals; the pulp cavity and canals are filled with some aseptic material that can be easily removed if necessary, such as gutta-percha dissolved in chloroform or softened by heat, and the form of the tooth is restored by filling. An inflamed pulp if left untreated will sooner or later suppurate or become gangrenous and septic, and very probably occasion periodontal inflammation. The cavity and root-canals should be fully exposed, all septic *débris* removed by means of hand instruments and revolving root-canal drills, and the cavity rendered as aseptic as possible with formalin or other antiseptic of a penetrating nature. The root-canals, pulp cavity, and tooth, can then be filled as before.

The pulp when not exposed is liable to degenerative changes, such as calcification and fibrous degeneration, especially when irritated by caries extending partly through the dentine, or by metal fillings conveying changes of temperature, and will then give rise to pain, which is often referred to the endings of distant branches of the fifth nerve. Treatment consists in devitalisation and treatment as before. Arsenious acid will act upon a pulp through a considerable thickness of dentine.

DISEASE OF THE PERIODONTAL MEMBRANE.

Acute inflammation of the periodontal membrane is usually caused by septic infection through one or more of the root-canals of a tooth. Treatment consists in cleaning and antiseptic treatment of these canals as previously described, and counter-irritant application to the mucous membrane of the gum, such as equal parts of tincture of aconite and iodine, or capsicum plasters. If this method of treatment fails, the tooth must be extracted.

Chronic inflammation of the periodontal membrane is also usually due, in the first place, to septic infection through a tooth, and may lead to cementosis, or absorption, or both. Treatment by antiseptics is less likely to be effective than in the case of acute inflammation.

Slight intermittent periodontitis occurs by extension from an inflamed pulp, and is relieved by treatment directed to the condition of the pulp. Cementosis occurring in teeth with live pulps, often in a condition of degeneration, does not generally respond to treatment, but sometimes the pulp may be devitalised with good effect. Slight chronic periodontitis of several teeth sometimes occurs as a manifestation of rheumatism.

ALVEOLAR ABSCESS.

This occurs when suppuration follows on periodontitis, and is always connected with a tooth with a dead and septic pulp. In the case of an **acute abscess**, suppuration usually commences between the root of the tooth and the alveolus, and, after absorption of bone, proceeds more rapidly outside the alveolus. The abscess may point within the mouth or on the face. The site depends upon the position of the tooth and the degree of resistance in different directions. Treatment depends upon the severity and extent of suppuration and the particular tooth concerned. When the abscess is threatening to point on the face, it is usually best to remove the tooth at once so as to evacuate the pus inside the mouth and prevent a permanent scar; in such cases the formation of an external opening may sometimes be prevented by supporting the skin with gauze and collodion. When, however, this treatment fails, or it is obvious that an external opening must occur, it is better to incise the abscess than to allow it to burst. A drainage tube is not generally necessary or desirable. When the abscess threatens to point within the mouth, the proper treatment depends upon the value and usefulness of the tooth, and the possibility of saving it. A premolar or molar very carious should usually be extracted at once. An incisor, or a posterior tooth not very carious, should be saved if possible. The pus should be evacuated by incision within the mouth at once; this gives immediate relief. The abscess cavity should be syringed with antiseptic lotion until suppuration ceases and then allowed to close. Antiseptic treatment should then be adopted for the root canals of the tooth, and a permanent cure is likely to result. There is not often much difficulty in deciding which tooth is the cause of the abscess; it is probably tender to percussion, and there is generally a history of its having been much more tender for a few days prior to swelling having taken place. The position of the swelling in the sulcus between the cheek and alveolus is also a guide, but the general swelling must not be too far relied upon, as effusion from an upper molar abscess descends by gravity and causes swelling of the whole of the side of the face below the border of the mandible. In such cases, however, there is no marked swelling in the sulcus between the alveolus of the mandible and the cheek.

A considerable amount of effusion and infiltration of tissues sometimes occurs. This in connection with a second or third lower molar may cause trismus, and the mouth may have to be forcibly opened under an anæsthetic before the offending tooth can be extracted or even diagnosed.

In other cases the tissues around and below the mandible become hard and brawny, and the swelling extends far down the neck. This condition of cellulitis of the neck, called angina Ludovici, is a dangerous one. It may by itself cause serious impediment to respiration, and the administration of any anæsthetic causing further congestion, such as nitrous oxide or ether, is attended with great risk. For further consideration of this condition, *see* Cellulitis, Vol. I.

Chronic Alveolar Abscess may supervene on acute abscess, or may arise gradually, but in a similar manner, by slow absorption through the alveolar wall. A chronic sinus then persists, which may remain open, or may close and open periodically. Treatment of the tooth is less likely to be successful than in the case of an acute abscess, and is rarely so if the sinus has persisted for several months or years. Sometimes enlargement of the apical foramen of the root, and syringing of peroxide of hydrogen or other antiseptic through the whole track of the sinus, may effect a cure, but chronic inflammation and thickening of the periodontal membrane, accompanied by absorption or cementosis, cannot usually be cured without extraction of the tooth.

When suppuration, acute or chronic, occurs in connection with a deciduous tooth, the tooth should be extracted at once.

CHRONIC SUPPURATIVE PERIODONTITIS.

This disease, commonly called **Pyorrhœa Alveolaris**, usually affects several teeth, and is characterised by marginal gingivitis, absorption of alveolus (Fig. 9), the formation of pockets between the teeth and gums, discharge of pus, deposit of calculus on the teeth, and loosening of the teeth. The relative degree of prominence of these symptoms varies very much in different cases. The more acute cases, where the gums are markedly inflamed and the discharge of pus is considerable and the teeth are much covered with tartar, are more amenable to treatment than chronic cases exhibiting slow absorption, with anæmic gums and little or no discharge of pus. The first essential is to remove all deposit from the teeth by means of properly devised scalers; astringent and antiseptic substances, such as sulphate of copper, aromatic sulphuric acid, etc., may then be applied from time to time in the pockets between the teeth and gums, but it is difficult to disinfect the tissues successfully by these means. Cataphoresis or ionic medication by means of the constant current, associated with the use of such mild antiseptics as argyrol or iodine dissolved in potassium iodide, is, however, often very successful in curing or checking the disease. Vaccine treatment has also been used with good results. In all cases a mouth wash containing formaldehyde in a strength of about 1 per cent. should be used frequently. When the disease cannot be cured, or kept well in check, so that the discharge of pus is abolished or reduced to a negligible amount, the only treatment is extraction of the teeth affected; and as there is risk of serious disease from gastro-intestinal absorption when pus is

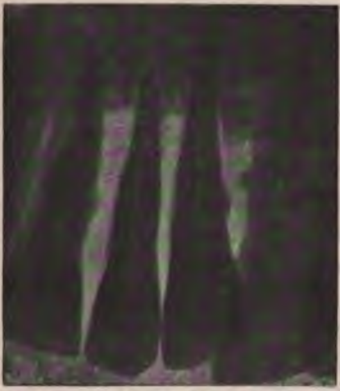


FIG. 9.—Radiograph, by Mr. C. A. Clark, showing much absorption of bone in pyorrhœa alveolaris.

constantly swallowed, this treatment must sometimes be adopted as the lesser of two evils.

FRACTURE.

Treatment depends upon whether or not the pulp chamber is opened. If it is not, the form of the tooth may be restored by the fitting of a porcelain addition. Sometimes, even when the pulp is not exposed as the result of fracture, it dies; it may then become gradually reduced to a mummified condition or undergo septic decomposition. In the latter event periodontal inflammation generally ensues. Discoloration indicates death of the pulp, the diagnosis of which may be confirmed by loss of sensibility to changes of temperature. Treatment consists in drilling into the pulp chamber, removing all *débris* from the root canals and rendering as far as possible aseptic. When the pulp is exposed by fracture of the crown it practically always dies, and it is best to devitalise the pulp and "crown" the tooth by one of the methods presently referred to. Oblique or longitudinal fracture involving the root usually entails extraction.

DISLOCATION.

This occurs as the result of a fall or blow. If the tooth has not been dropped on the ground or otherwise subjected to septic contamination, it should be gently washed in normal salt solution and firmly replaced, under general anæsthesia, after the socket has been freed from blood clot and syringed with warm water. A metal splint should be cemented to it and the adjoining teeth, and left in position for several weeks. Reunion of the periodontal membrane will then take place and the tooth will become perfectly firm. Reunion of the vessels and nerves of the pulp is less probable, but does take place even after two or three hours, and in the case of a tooth in which the apex has been fully calcified, so that the foramen is reduced in calibre.

After the splint has been removed the tooth should be tested from time to time to ascertain whether the pulp is still alive. If the tooth has been out of its socket longer than about three hours, the chance of the pulp retaining its vitality is remote, and it is best to drill into the pulp chamber, remove the pulp, and fill the root canal, before restoring the tooth to its socket.

If the tooth has lain on the ground or otherwise become contaminated, it should be washed thoroughly in normal salt solution and then placed in an efficient, but non-caustic and non-corrosive, antiseptic before being replaced. It is better to damage slightly the periodontal membrane than to run any risk of septic infection of the socket. Teeth which have been replaced often remain firm and useful for many years.

TREATMENT OF ROOTS BY ARTIFICIAL CROWNS.

Teeth which are so far carious as to be past treatment by filling may be restored with the aid of artificial crowns.

The chief essentials for success are that the periodontal membrane shall not be diseased and that the caries shall not have extended far below the gum level at any point. Crowns may be made of gold, platinum, porcelain, or various combinations of these materials. The methods of preparing the root, the choice of material, and the methods of manufacture, are matters for the consideration of the dentist, but a few words may be said as to the usefulness of crowns and the justifiability of this treatment in relation to the hygiene of the mouth and septic absorption. It is sometimes argued in the case of hollow gold crowns that experience has shown the impossibility of making a perfectly fitting joint, and that the cement with which the crown is fixed becomes in time very septic; also that the edge of the gum is irritated and becomes affected by chronic gingivitis. This criticism is sound in the main, but need not involve the abolition of gold crowns and does not apply to all-porcelain crowns. To a sound root a gold crown may be fitted, with sufficient care and skill, in such a way as not to cause irritation or be a source of dangerous sepsis; but solid crowns, whether of porcelain or metal and porcelain, are to be preferred, and a square flush joint well fitted is better than an overlap joint. In all cases the cement used for fixing crowns should have incorporated with it a solid antiseptic likely to remain for a long time, such as Thymol. Deposit of food detritus in the form of a white film occurs sometimes on gold crowns in parts inaccessible to the tongue or tooth-brush, but this is scarcely ever noticeable in the case of porcelain.

On the whole it may be said that a properly made crown fitted to a root under suitable conditions is nearly as useful a member as a natural tooth and better than one much restored by filling; on the other hand, errors in judgment, or want of care, and the crowning of diseased roots, may be a source of danger to general health. It is as absurd to condemn the method on account of individual cases as to extol it too much in face of them.

A Bridge consists in the restoration of several teeth by fixation to two or more teeth or roots. The principles are the same as for crowns, but the liability to disease of the roots from over-use, and to deposit of food particles (and consequent sepsis) on parts not easily kept clean by natural or artificial means is considerably greater. Small bridges, especially in the front of the mouth, are often justifiable and very useful, large and extensive bridges but rarely so.

EXTRACTION OF TEETH.

However far decayed or diseased the crown of a tooth may be it can usually be restored by filling or by an artificial crown; but chronic disease of the periodontal membrane or alveolus can often only be cured by extraction of a tooth. Deciduous teeth unduly retained may require to be extracted in order to avoid interference with the normal eruption of the permanent successors.

Skill in the extraction of teeth can only be acquired by considerable practical experience, but the methods and principles should be first understood; unfortunately the word "pulling" often gives rise to misapprehension, and the application of such force, or indiscriminate wrenching, can only end in fracture of the tooth and, very possibly, serious injury to the bone.

The patient should be seated in a strong chair, with the head slightly thrown back, and with the neck and head well supported. The light should come from a little to the left of the patient and above his level, so that the operator, standing always on the right side, and always in front of the patient, except when extracting lower right premolars and molars, does not get in his own light.

The most usual instrument is a pair of forceps, which are made of various shapes in accordance with the form of the crown and roots of different teeth. They should be strong without being clumsy, as any want of rigidity very much diminishes the sense of touch by which an experienced operator estimates almost instantaneously the kind and amount of resistance to be encountered. They are often made too short in the handles and are then apt to shift in the palm; if the handles reach as far as the interval between the thenar and hypothenar eminence, this will not occur. The thumb should be placed just below the hinge in order to control the degree of closure of the blades until these have been properly applied, but should then be slipped up a little further so that it may not be pinched between the handles in case the crown or root is crushed or the forceps slip.

The proper use of the left hand is quite as important as the right. It serves four purposes, namely, to keep the cheek, lips and tongue out of the way; to guide the blades of the forceps into the correct position; to prevent the tooth or root slipping from the forceps into the pharynx or trachea; and, in the case of lower teeth, to support the mandible.

Extraction consists of three stages: (1) Application of the blades; (2) separation of the roots from the alveolus; and (3) removal of the tooth and roots from the socket and mouth. Success depends very largely on the first of these, and it should be understood that all teeth should be grasped by the root or roots. The blades should pass between the gum and the root, and be pressed forcibly into position with a slight rocking movement, and should not be firmly closed until this has been done. Separation involves the fracture or bending of one or both plates of alveolus; the amount of force necessary for this varies greatly, the densest bone being usually in the mandible of men. In children the bone is elastic and gives readily to slight pressure. Teeth which have been for long affected by chronic periodontitis are likely to have thickened cementum and to be very firmly implanted. The outer alveolar plate is stronger than the inner except at the back of the mandible, and for this reason the chief pressure should usually be outwards. It is well to make certain that the inner blade, which, especially in the case of lower molars, is less easily seen, is pushed well in, and to make sure of this the forceps should be first slightly tilted inwards. They should then be firmly pressed outwards, and, at the same time, into the socket. If this is not done, or if the forceps are pulled at all, the tooth will fracture transversely at the neck. This incorrect method is analogous to pulling a nail from a board when the nail is usually bent in the process; the bend corresponds to the fracture in the rigid tooth. If the outer plate of alveolus does not give way, the forceps should be pressed inwards and then outwards again more firmly. Only experience will enable the operator to judge how much force may be used without risk of fracture.

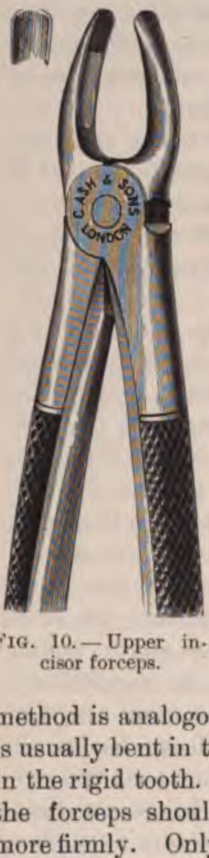


FIG. 10.—Upper incisor forceps.

In the case of single roots, or teeth with approximately conical roots, rotation may be combined with outward pressure. In the third stage alone, when the tooth has been rendered quite loose in its socket, may a certain amount of traction be employed; and a slight rotatory movement will often disengage the root from the bone or adjacent teeth. It is important in this stage to keep the blades of the forceps surrounded by the thumb and forefinger of the left hand, as, especially in the case of an upper root, it may easily slip from the forceps.

As an alternative to forceps the elevator may sometimes be used for lower molars or roots. It consists of a simple nearly pointed blade, straight or with a bend near the point. Its use will be described in connection with the appropriate teeth.

METHODS APPLICABLE TO INDIVIDUAL TEETH.

Upper Incisors.—The operator uses a pair of straight blade forceps (Fig. 10). It is best to apply the inner blade first and to tilt slightly inwards before bending more forcibly outwards; in some cases the tooth gives more easily to inward pressure. A certain amount of rotation may also be used as the root is nearly conical. The lip should be kept out of the way with the left forefinger, which, with the thumb on the inside, grasps the alveolus. The use of the left hand is similar for left upper posterior teeth (Fig. 11).

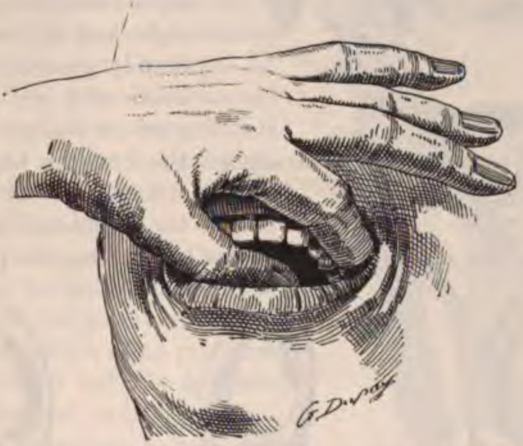


FIG. 11.—Use of left hand when extracting on left side of upper jaw. (Pye's Surgical Handicraft, Wright, Bristol.)

Upper Canines.—The method is similar but the root is long and strong and more force is necessary. For the right canine and for all right upper posterior teeth the forefinger of the left hand is placed on the inner side, and the thumb on the outer side, of the alveolus (Fig. 12).

Upper Premolars.—The root is flattened, and in the case of

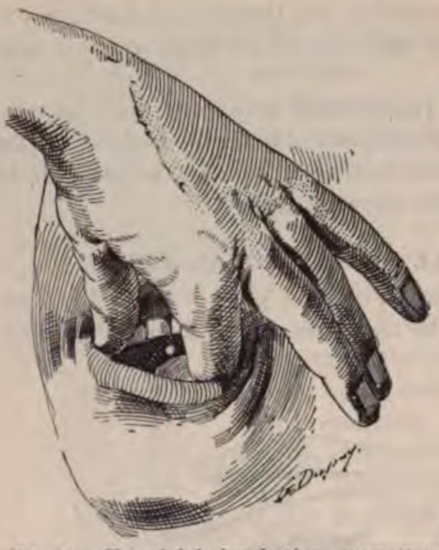


FIG. 12.—Use of left hand when extracting on right side of upper jaw. (Pye's Surg. Handicraft, Wright, Bristol.)

the first premolar usually bifurcated, so that rotation is inadmissible. For the first premolar straight forceps should be used, but for the second slightly curved (Fig. 13) may be preferred. The method of use is similar to that for incisors.

Upper Molars (First and Second).—The forceps for these (Figs. 14, 15 and 16) are curved and made in pairs, right and left, with an outer doubly grooved and pointed blade and an inner singly grooved blade. The point of the former is to pass between the two buccal roots, while the latter embraces the palatine root. The anterior buccal root is larger than the posterior, and

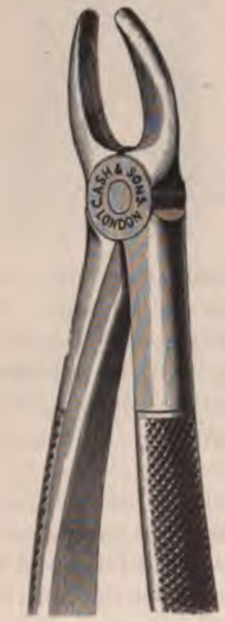


FIG. 13.—Upper premolar forceps.

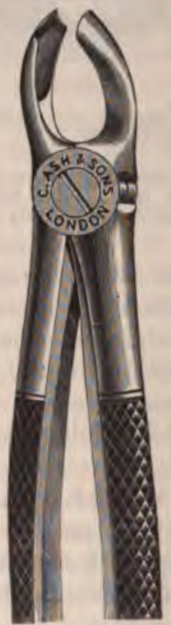


FIG. 14.—Upper molar forceps for right side.

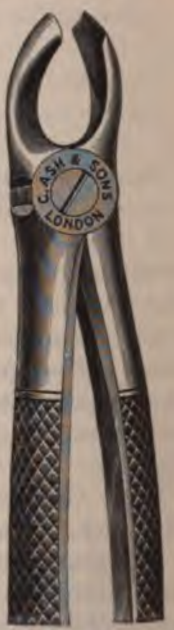


FIG. 15.—Upper molar forceps for left side.

on a plane anterior to the palatine; it is therefore necessary to keep the external blade of the forceps in advance of the internal, and, especially in the case of second molars, to keep the handles well back, without, however, pinching the lip against the lower teeth. It will often be necessary to use alternately inward and outward pressure two or three times to loosen the tooth.

Upper Molars (Third).—The forceps have a greater curvature, and have both blades similar to the inner blade of the forceps just described. The blades should be applied very carefully and extraction should be deliberate, as there is risk of fracturing the tuberosity by undue violence.

Upper Molar Roots.—Curved forceps (Fig. 17) with simple blades should be used when caries extends much below the gum margin on either side. The outer blade should usually be applied to the anterior root and the inner to the palatine. When caries is extensive on one side, so that the edge of the root is concealed by the gum, it is best to apply first to the less decayed side, and then very carefully to the other, and in loosening the roots pressure should be almost entirely towards the more decayed side. In this way the roots may often be removed together, but if one can be removed the rest is usually easy, as one blade may be placed in the socket of the extracted root. In some cases of difficulty an attempt may be made to split the roots by applying the outer blade to the posterior buccal root and the inner to the interval between the palatine and anterior buccal. Separated roots are usually removed easily by means of rotation with slender bayonet-shaped forceps (Fig. 18).

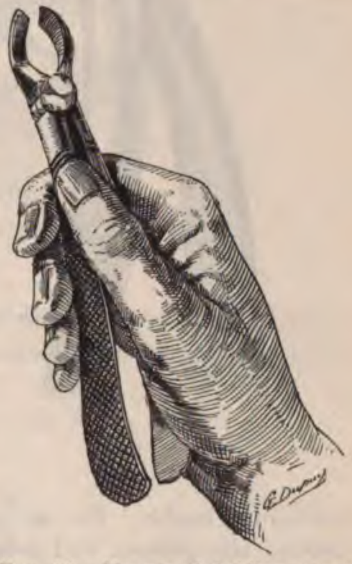


FIG. 16.—Manner of holding upper molar forceps. (Pye's Surg. Handicraft, Wright, Bristol.)

Lower Incisors and Canines.—Simple-bladed hawk's-bill forceps (Fig. 19) are used, and the movement to loosen should be chiefly outwards. The forefinger of the left hand should be between the alveolus and lip, and the second finger between the alveolus and tongue, and the thumb should support the mandible. This position for the left hand should be adopted in the case of all lower teeth on the left side (Fig. 20).

Lower Premolars.—On the left side the same forceps are used, and the same methods, except that a certain amount of rotation is sometimes useful. For all right lower teeth the operator stands behind the patient and brings the left arm round the patient's head, and grasps the alveolus with the thumb between the alveolus and the tongue and the forefinger between the alveolus and the

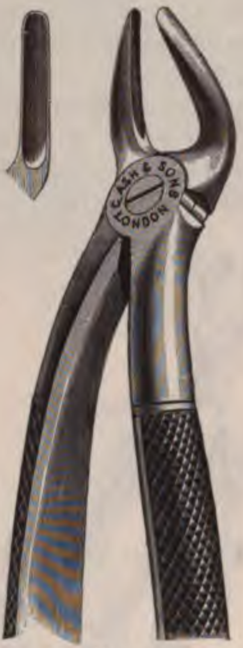


FIG. 17.—Upper root forceps.

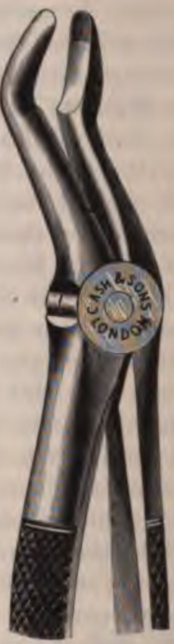


FIG. 18. — Bayonet-shaped forceps for detached upper molar roots.

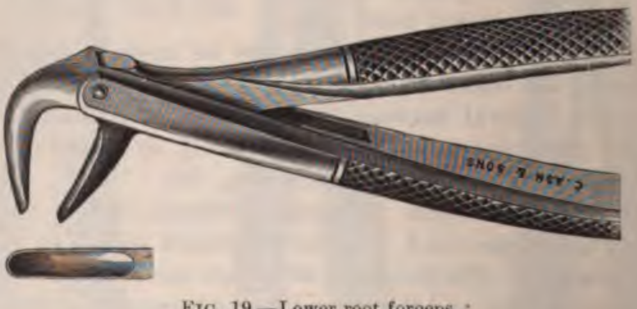


FIG. 19.—Lower root forceps.

cheek, the remaining fingers being used to support the mandible (Fig. 21).

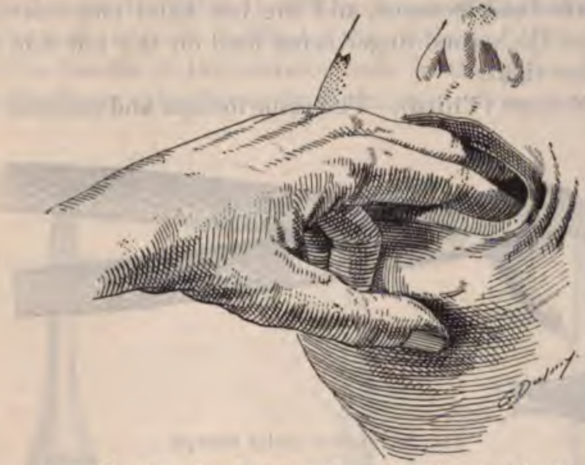


FIG. 20.—Use of left hand when extracting on left side of lower jaw. (Pye's Surg. Handicraft, Wright, Bristol.)

Lower Molars.—Hawk's-bill forceps with a double groove and a point to pass between the roots are used (Figs. 22 and 23); the

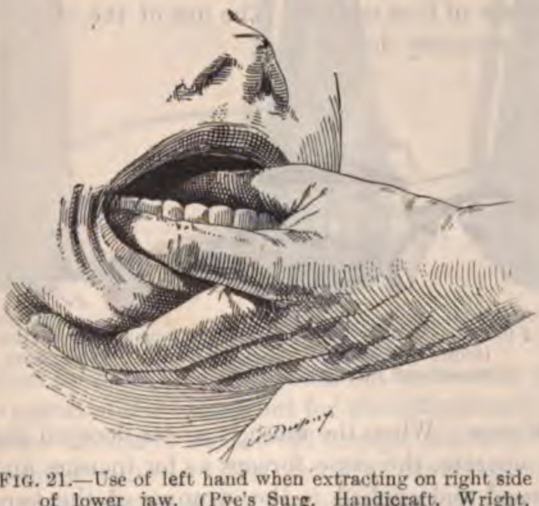


FIG. 21.—Use of left hand when extracting on right side of lower jaw. (Pye's Surg. Handicraft, Wright, Bristol.)

tongue is apt to get in the way and the inner blade should be applied first; the forceps should be quite square to the tooth. Outward pressure is the more useful in loosening. These teeth are very liable to fracture on account of the density of the bone; the forceps should be firmly pressed downwards all the time until the roots have been loosened, and the left hand may conveniently assist in this, the second finger being used on the left side and the thumb on the right.

Lower Molars (Third).—The same forceps and methods may be employed, or a pair of forceps with straight handles and downward curved blades may be used. In that case the operator stands in front and uses the left hand in the same way on the right as he always does on the left. The inner plate of alveolus is a good deal thinner than the outer, therefore inward pressure is more useful than in the case of first molars. The use of the elevator for these teeth will be presently described.

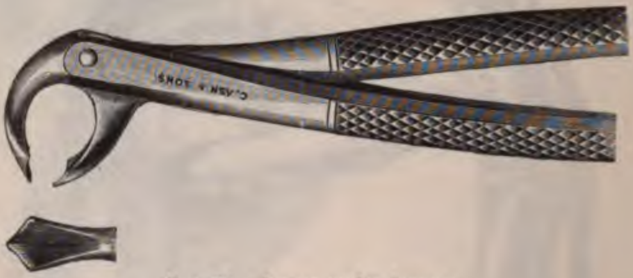


FIG. 22.—Lower molar forceps.

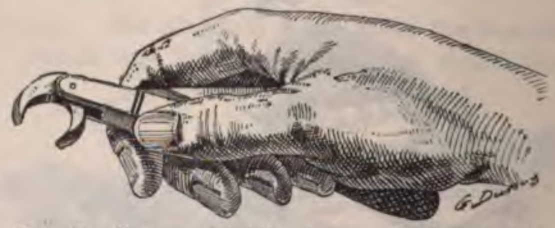


FIG. 23.—Manner of holding lower molar forceps (the thumb is placed too near the blades). (Pye's Surg Handicraft, Wright, Bristol.)

Lower Roots.—When the tooth is so far decayed that the roots are nearly separate, the same forceps as for incisors and premolars should be used and applied to the stronger of the two roots. As regards caries extending further on either side the same principles apply as to upper roots. When one root has been removed, the other may also be removed with forceps, or more easily with a curved elevator, the use of which will presently be described.

A straight elevator (Fig. 24) is usually the best instrument with which to prise a lower third molar from its socket, because these teeth are difficult to reach effectually with forceps, and the backward curvature of the root, or roots, facilitates the method of lifting from the front. The handle of the elevator rests in the palm of the hand and the forefinger extends nearly to the point, along the flat side of the blade when in use on the left side, and the convex side on the right. The operator stands in front for the left side and behind for the right, as for the use of hawk's-bill forceps, and employs the left hand in a similar manner. The point of the elevator is firmly pressed downwards with a slightly rotatory movement between the tooth and the second molar on the outer side, and the handle is then depressed so as to lever the tooth upwards, the second molar acting as a fulcrum. This process is repeated until the tooth is loosened, when it may often be conveniently removed with forceps.

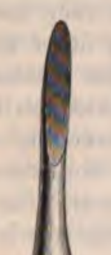
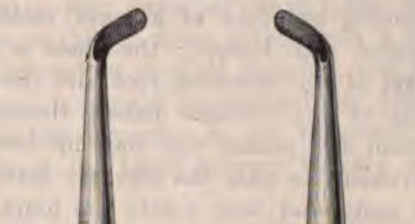


FIG. 24.—Straight elevator.



FIGS. 25 and 26.—Curved elevators.

The second finger of the left hand on the left side, and the thumb on the right, should be placed behind the tooth to prevent slipping of the elevator. There is some risk of injury to the soft parts or to the operator's left hand, and on the latter account it is unwise to use the elevator in a very septic mouth or one affected by secondary syphilis. In any case the elevator for third molars should only be used by experienced operators.

The curved elevator (Figs. 25 and 26) is very useful for removing one root of a lower molar when the other has been removed with forceps; the blade is passed to the bottom of the socket of the extracted root and the handle rotated, so that the point of the elevator passes through the intervening alveolar septum and pushes the root up from below. Sometimes it is convenient to pass the elevator between the root and the adjoining tooth and then rotate the handle, so that the root is pushed into the socket of the extracted root.

Temporary teeth are extracted with similar instruments of smaller make. The roots of temporary teeth when not absorbed are widely spread and firmly implanted, and extraction causes a good deal more pain than is often thought. The forceps should not be pressed too far towards the roots on account of the subjacent permanent tooth.

COMPLICATIONS AND CASUALTIES OF EXTRACTION.

Fracture of the Tooth.—The possibilities of this have already been indicated. The most usual causes are undue haste and use of traction, instead of pressure into the socket, during lateral movements to loosen the tooth. If the roots cannot be removed at the time, a small quantity of pure carbolic acid should be applied to cauterise any portion of exposed pulp. After a few days, inflammatory processes will probably have loosened the roots and made extraction easier.

Extraction of an Adjacent Tooth.—When the tooth to be extracted is overlapped by the adjacent teeth, these may be loosened or forced from their sockets. A tooth so dislodged should be at once replaced and will probably unite; the pulp will probably die and need subsequent treatment, but in a young subject it also may reunite.

Fracture of Bone.—Small pieces of alveolus are often fractured and portions may exfoliate later. More extensive fractures must be treated with suitable splints.

Laceration of the Gum.—The gum contains much elastic tissue and readily reunites when torn unless it is only attached by a thin pedicle, when it should be cut away.

Hæmorrhage.—Deaths have occurred from bleeding after tooth extraction in the case of patients suffering from the hæmorrhagic diathesis. In any case, profuse or prolonged bleeding is dangerous and needs prompt and watchful treatment.

The operation should be avoided if possible when the patient is known to be hæmophilic, but if that is impossible it is advisable for the patient to rest for three or four days beforehand and take chloride or lactate of calcium in 10 gr. doses three times a day. Only one tooth should be extracted on the first occasion, and this is best done in the morning. It should be remembered that a patient who bleeds freely on one occasion is not necessarily a "bleeder"; the coagulability of the blood appears to vary with general conditions of health.

Primary hæmorrhage should first be treated with very hot, or ice-cold, water, to which some tincture of hamamelis may be added, and the patient should not spit out the blood, as the suction encourages hæmorrhage, but should let it run. This treatment is often successful, but if it fails the socket must be plugged with a strip of boracic gauze soaked in adrenalin chloride and lightly squeezed out, and carrying as much tannin as it will absorb. The plug should be built high, above the level of the crowns of the adjacent teeth, and firm pressure should be maintained with the finger for a considerable time, after which the jaw may be fixed with a four-tail bandage so that the opposing teeth bite into the plug and keep it in place. It is well to tuck the end of the strip of gauze well into the socket, so that it may not easily get loose. The plug should not be removed until it becomes quite loose, but may be trimmed carefully with scissors after about twelve hours if an end has become loose. The patient should rest with the head propped up and be fed on cold liquids. Gallic acid given in 15 gr. doses every two hours for about twelve hours is sometimes useful Some operators use the extracted tooth, with or without an intervening layer of gauze, as a plug. The injection of horse serum into the rectum is used to promote coagulation, but as this treatment is generally tried in conjunction with local and medicinal treatment its efficacy cannot be definitely pronounced upon.

Reactionary hæmorrhage is not, as a rule, profuse, but may be very persistent and cause the loss of a great deal of blood. Local treatment is similar, or sutures may be employed.

In some cases the blood shows little disposition to coagulate; in others it clots freely in the mouth. Coagulation is encouraged by the exhibition of hæmostatic drugs, such as perchloride of iron or gallic acid; contraction of the small vessels may be produced by injection of ergot, which, however, raises the blood pressure.

Secondary hæmorrhage is very rare.

Septic Infection of the Socket sometimes occurs, and it is rather remarkable that it does not happen oftener. The socket should be swabbed out with carbolic acid (1 in 20 or stronger), and syringed frequently with the following: ℞. Liq. Potass., ʒj; Acid. Carbol. Liq., ʒss; Tinct. Cocci., q.s.; Aq., ad ℥j. Misce. *Sig.* Not to be taken. Use one teaspoonful in half a tumbler of warm water.

This may also be used as a mouth wash after extraction in septic mouths or when several teeth have been removed.

EXTRACTION UNDER ANÆSTHETICS.

Extraction of a large number of teeth or roots under prolonged anæsthesia will usually fall to the dental surgeon, but there are some important points in connection with operations under nitrous oxide gas which should be remembered.

The operator should never hurry; time spent in applying the forceps carefully is time saved, because the actual extraction can then usually be done sufficiently quickly without trouble.

When lower teeth are being extracted, the tongue often gets in the way. In pressing this aside with the finger or thumb of the left hand the operator is apt to impede breathing, and should endeavour to do so only momentarily, and then, when the inner blade of the forceps is in place, allow the tongue to come up again.

Particular care should be taken, when operating under an anæsthetic, that the fingers of the left hand surround the blades of the forceps and prevent any root slipping into the pharynx; the chief risk is in connection with upper roots. If a root does slip into the mouth, the operator should not extract another tooth until he has removed the first from the mouth. Sometimes this can be done easily, but in case the root falls on the back of the tongue the best course is to push the patient's head forwards, as any attempt to hook the root forwards with the finger may induce inspiration. For the patient to swallow a root, which however is unlikely, is a minor evil compared with the risk of its passing into the air passages.

Local Anæsthetics.—Injection of cocaine or one of the allied drugs such as beta-eucaine, stovaine, or novocaine is useful for many cases of extraction of one or two teeth. Probably novocaine, not exceeding ⅔ gr., with adrenalin chloride, is the best for the purpose and the least toxic, but it should always be remembered that different persons exhibit varying degrees of susceptibility to these drugs. The risk of cardiac failure should not be ignored and appropriate measures for dealing with collapse should be at hand. The syringe and needle should be boiled for ten minutes at least. Probably the best preparation of the drug is a tabloid dissolved in ½ drachm of distilled water immediately before being used. The mucous membrane should be sterilised as far as possible, and it is a good plan to apply a small drop of pure carbolic acid to the points where the needle is to enter; this serves the double purpose of sterilisation and surface anæsthetisation. The anæsthetic should be injected slowly and thoroughly on both sides of the alveolus. The first point of entry should be about ⅛ inch from the gum margin. When the gum in the vicinity has become blanched and of a cheesy consistence, the needle should be reinserted at the edge of this area and passed nearly horizontally and obliquely towards the bone. Altogether, about four punctures are usually desirable.

As soon as the gum has become insensitive to firm pressure with a hard instrument the operation may be proceeded with. Injection with a fresh supply of anæsthetic in case of difficulty, or for another tooth, is inadmissible on the same day. There is often considerable pain of reaction lasting for perhaps a couple of hours when sensibility is restored. Swelling of the parts may be due to imperfect aseptic precautions, but it is possible that the distension of the tissues renders them more liable to subsequent infection by organisms already in the mouth.

DISEASES OF THE GUMS OF DENTAL ORIGIN.

Marginal gingivitis, as the result of uncleanliness of the mouth and deposit of tartar, is very common, and is often mistaken for "pyorrhœa alveolaris." Ordinary hygienic and antiseptic treatment soon effects a cure. The condition is almost universal in mouth-breathing and develops into hypertrophy; it is then difficult to treat. An astringent, such as glycerine and tannin, should be applied to the gums frequently. Mild forms of stomatitis are frequent in young children with carious deciduous teeth, and occur also in adults. Treatment of the teeth, when necessary, mild antiseptic and astringent mouth washes, and a purge, are usually sufficient treatment.

Follicular stomatitis, characterised by small ulcers, usually in the sulcus between the cheek and gums, occurs more often in children than in adults. The ulcers should be touched with nitrate of silver or the following: ℞. Acidi Carbolici Glacialis, Liq. Potassæ, āā ʒj; Aq., ad ʒiij. Misce. The general condition should be attended to.

A definite condition of ulcerative stomatitis occurs most usually in children. It usually starts from a loose, septic, deciduous tooth or root, and ulceration spreads rapidly round the margin of the gums, and the adjacent teeth become loose. The edge of the gum appears white from the presence of necrosed tissue, the mucous membrane in the vicinity becomes acutely inflamed and in parts ulcerated, and ulcers appear on the inside of the cheeks where the mucous membrane comes in contact with the ulcers on the gums. The condition is a serious one and is usually marked by febrile symptoms from septic absorption. Treatment should be immediate and somewhat drastic. The tooth from which the disease has started should be removed and any others which are very loose, but it is not advisable to extract a large number of teeth and thereby facilitate absorption. Carbolic acid (1 in 10 or 20) should be carefully swabbed round the edges of the affected gums, and an antiseptic mouth wash prescribed. A purge should be given, and if there is any febrile disturbance the child should be kept in bed and given digestible, nutritious food, and treated with tonics. Chlorate of potash lozenges (about one grain for each year of age) should be slowly dissolved in the mouth three times a day. This treatment causes rapid improvement.

A condition of acute ulcerative stomatitis sometimes occurs in adults from neglected suppurative periodontitis or other septic focus in the mouth. Such a chronic condition may have existed for a long time, and apparently the acute affection supervenes on the chronic by reason of lowered resistance from general causes. In severe cases large ulcers appear in different parts of the mouth, on the gums and cheeks, and extensive sloughs may form; the teeth rapidly loosen. The condition is a very serious one, and several deaths have occurred. *Very* loose teeth may be removed at once, but it is most undesirable to render absorption more easy. The patient should be kept in bed and the bowels kept open. Local antiseptic treatment is of the first importance. An efficient but non-corrosive antiseptic, such as lysoform, or lysol, should be employed. It should be used in small quantities in strong solution, or undiluted, to swab round the teeth and sloughing portions of gums, and the process should be repeated daily, or twice a day if necessary. A more dilute solution should be used to syringe round the teeth; and as a mouth wash, every hour, and before and after food, which should be of a liquid character. The patient's strength must be kept up and the general condition attended to.

The general symptoms of sapræmia or septicæmia may indicate the desirability for vaccine treatment as in other cases of a like kind. When the state of the mouth has improved all teeth that do not seem likely to become firm and capable of being rendered healthy should be removed under a general anæsthetic, and bacteriological treatment directed to improving the opsonic index of the patient should be undertaken.

Specific forms of stomatitis, such as those due to mercury or other drugs, or to diseases, such as syphilis, require, in addition to ordinary antiseptic or astringent local application, treatment suitable to the general condition.

DENTAL CYSTS.

These arise as the result of proliferation of epithelial "rests" included in the mesoblast, from the irritation of septic root-canals and passage of septic material through the apex or apices. They grow slowly and contain a clear fluid and cholesterin crystals. When they have attained to any considerable size, the bony wall is in parts completely absorbed, and only a thin covering of mucous membrane and lining membrane remains. Extraction of the tooth or root will sometimes evacuate the fluid and effect a cure, but the cyst is apt to re-form. Extraction is, therefore, not the best treatment and loss of the tooth is by no means necessary.

The outer wall of the cyst should be incised, and an opening made large enough to admit a finger easily. The interior of the cyst should be scraped and swabbed out with a small quantity of pure carbolic acid or solution of chromic acid. It should then be packed with gauze and repacked at first every day and afterwards less frequently, so that it may granulate up from the bottom. When the cavity has thus become partly obliterated, frequent syringing may take the place of packing, especially if the cyst is in the maxilla, and therefore less likely to admit food particles. The tooth must be treated antiseptically.

FIBROMA OR EPULIS.

These may be hard or soft, according as the fibrous or cellular elements predominate. They grow usually from the periodontal membrane, and are pedunculated, and become flattened or shaped between the adjacent teeth and the lips or cheek. Simple excision is not sufficient, because the tumour will probably grow again. It is necessary to remove the periodontal membrane and septum of bone between two teeth from which it grows, and for this purpose the extraction of one or two teeth is necessary. The gum should be cut away freely, and the septum of bone and adjacent alveolus on either side entirely removed with forceps.

ODONTOMA.

The pathological variety of these aberrations is considerable, but their consideration does not come within the scope of this work. Clinically, they may be solid or cystic. Treatment in either case consists in removal. For the former it is often necessary to remove portions of bone before they can be extracted. In the case of the latter, incision, removal of the aberrant tooth, and treatment similar to that for dental cyst, will effect a cure.

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